

CHAPTER 29

INDIAN AGRICULTURE : UNDER THE FIVE YEAR PLANS : THE GREEN REVOLUTION

"Agricultural development is central to economic development of the country."

— Tenth Five Year Plan



1. THE PLACE OF AGRICULTURE IN THE NATIONAL ECONOMY

Agriculture has always been the backbone of the Indian economy and despite concerted industrialisation in the last six decades, agriculture still occupies a place of pride. It provides employment to around 60 per cent of the total work force in the country. The significance of agriculture in the national economy can be best explained by considering the role of agriculture under different heads.

(i) Share of Agriculture in the National Income.

TABLE 1: Share of Agricultural Sector in Total Gross Domestic Product (At 1999-00 Prices)

Year	Agriculture (2)
1950-51	56.5
1970-71	45.9
1990-91	34.0
2000-01	24.7
2005-06	19.55
2006-07	18.51
2007-08 (2004-05 Prices)	17.8
2008-09	15.7
2009-10(PE)	14.7
2010-11(QE)	14.5
2011-12*	13.9

Note: Agriculture includes agriculture, forestry and fishing.

Source: Economic Survey 2007-08, Statistical Abstract of India 2008. CSO, National Accounts Statistics, 2010, (2004-05 Prices) *Advanced

PE Provisional Estimates; RE Revised Estimates

Figures provided by the Central Statistical Organisation (CSO) reveal that in 1950-51, the share of agriculture in GDP was around 55 per cent (Table 1). As the process of industrialisation and economic growth gathered momentum under the Five Year Plans with manufacturing and service sectors growing rapidly and agricultural sector limping along, the percentage share of agriculture in GDP declined and reached a level of 13.9 per cent in 2011-12.

Two important facts must be emphasised here:

- (a) Agriculture contributed a major share of the national income in India at one time.
- (b) The share of agriculture in national income, however, has been decreasing continuously while the

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shares of the major crops are increasing.

Comparatively, the share of agriculture in India's national economy is quite high. In 1950-51, it was 55 per cent of the work force in India. In France, the proportion is 68 per cent in Australia, this is 50 per cent.

It is only in the United States of America that the share of agriculture in the national economy is quite high. In 1950-51, it was 59 per cent in Britain, 58 per cent in Canada and 57 per cent in Australia.

(ii) Indian Agriculture in the National Economy

TABLE 2: Population

Total Population
Total Working Population
Population employed in agriculture, of which
Cultivators
Agricultural Labourers

SOURCE: [Agriculture](#)

Data provided by the Central Statistical Organisation shows that in absolute terms, the number of people working on land increased from 98 million persons in 1950-51 to 235 million in 2011-12. However, the number of people working on land decreased from 98 million in 1950-51 to 59 million in 2011-12.

The Tenth Five Year Plan projected that the share of the agricultural sector in the national economy would decline to 13.9 per cent of India's gross domestic product. The share of agriculture in the national economy is projected to decline to 13.9 per cent of India's gross domestic product by 2011-12. The share of agriculture in the national economy is projected to decline to 13.9 per cent of India's gross domestic product by 2011-12.

(iii) Implications of the Decline in the Share of Agriculture in the National Economy

shares of the manufacturing and service sectors are increasing.

Comparison can be made between the position of agriculture in India with that in the other countries as regards the share of agriculture in national income. In the United Kingdom and United States, only 2 to 3 per cent of the working population is engaged in agriculture; in France, the proportion is about 7 per cent; and in Australia, this is about 6 per cent.

It is only in backward and less developed countries that the working population engaged in agriculture is quite high. For instance, it is 35 per cent in Egypt, 59 per cent in Bangladesh, 50 per cent in Indonesia and 68 per cent in China.

(ii) Indian Agriculture and Pattern of Employment in the Country. Agriculture dominates the economy to such an extent that a very high proportion of working population in India is engaged in agriculture.

**TABLE 2: Population and Agricultural Workers
(in million)**

	1951	2001
Total Population of India	361	1029
Total Working Population	140 (100)	401 (100)
Population employed on land of which	98 (70%)	235 (59%)
Cultivators	70 (50%)	128 (32%)
Agricultural Labourers	28 (20%)	107 (27%)

SOURCE: *Agricultural Statistics at a Glance* (2007).

Data provided by the Census of India reveals that in absolute terms, agriculture provided employment to 98 million persons in 1951; the number of people working on land (cultivators and agricultural labourers) increased to 235 million in 2001. In terms of percentage, however, people working on land came down from 70 to 59 during the five decades between 1951 and 2001.

The Tenth Plan (2002-07) estimates that the agricultural sector still provides employment to 57 per cent of India's work force and is the single largest private sector occupation. It is, however, really disturbing that the proportion of agricultural labourers has increased from 20 to 27 per cent between 1951 and 2001 but that of cultivators registered a decline from 50 per cent to 32 per cent. This shows clearly the growing pauperisation of the rural peasantry.

(iii) Importance of Agriculture for Industrial Development. Indian agriculture has been the source of supply of raw materials to our leading industries. Cotton and jute textile industries, sugar, flour mills, vanaspati and plantations--all these depend on

agriculture directly. There are many other industries which depend on agriculture in an indirect manner. Many of our small-scale and cottage industries like handloom weaving, oil crushing, rice husking, etc., depend upon agriculture for their raw materials--together they account for 50 per cent of income generated in the manufacturing sector in India.

But then, in recent years, the significance of agriculture to industries is going down as many new industries have come up which are not dependent on agriculture. Under the Five-Year Plans, iron and steel industry, chemicals, machine tools and other engineering industries, automobiles, information technology etc., have come up in a big way.

However, in recent years, the importance of food processing industries is being increasingly recognised both for generation of income and for generation of employment.

(iv) Role of Agriculture in the Field of International Trade.

Importance of Indian agriculture also arises from the role it plays in India's trade. Agricultural products--tea, sugar, oilseeds, tobacco, spices, etc. --constituted the main items of exports of India. Broadly speaking, the proportion of agricultural goods which were exported came to 50 per cent of our exports, and manufactures with agricultural content (such goods as manufactured jute, cloth and sugar) contribute another 20 per cent or so; and the total comes to 70 per cent of India's exports in 1950-51. But with diversification of exports, more especially after the introduction of agricultural exports which were 18.5% in 1990-91 rose to 20.3% in 1996-97 and thereafter indicated a continuous decline and were of the order of only 9.9% in 2010-11.

Table 3 : Agricultural Exports as a percentage of Total Exports

	Agril. Exports (1)	Total Exports (2)	(1) as % of (2)
1990-91	6,013	32,527	18.5
1996-97	24,161	118,817	20.3
2000-01	28,657	201,356	14.2
2005-06	61,194	456,418	10.8
2006-07	62,411	571,779	10.92
2007-08	79,040	6,55,864	12.05
2008-09	85,952	8,40,755	10.22
2009-10	87,523	8,45,125	10.59
2010-11	1,13,116	11,42,649	9.9

Source : *Agricultural Statistics at a Glance* (2010), *Economic Survey 2011-12*.

(v) Role of Agricultural Sector in Economic Planning.

Importance of agriculture in the national economy is indicated by many facts. For example, agriculture is the main support for India's transport systems, secure bulk of their business from the movement of agricultural goods. Internal trade is mostly in agricultural products.

Further, good crops implying large purchasing power with the farmers lead to greater demand for manufactures and, therefore, better prices. In other words, prosperity of the farmers is also the prosperity of industries. Likewise, bad crops lead to a depression in business. Generally, it is the failure in the agricultural front that has led to failure of economic planning in particular periods.

Agricultural growth has direct impact on poverty eradication. It is also an important factor in containing inflation, raising agricultural wages and for employment generation.

It is clear, therefore, that agriculture has been the backbone of the Indian economy. The rural areas are the biggest markets for low-priced and middle-priced consumer goods, including consumer durables. Besides, rural domestic savings are an important source of resource mobilisation.

Accordingly, any change in the agricultural sector, positive or negative, will have a multiplier effect on the entire economy. Since 2002-03, Indian agricultural sector is almost going through a crisis—huge foodgrains surplus wiped out, large imports of wheat being planned and farmers' suicides more frequent all over the country. A nation of more than a billion people cannot be dependent on imports for basic items like foodgrains and edible oils. The Tenth Plan asserts emphatically that the agricultural sector acts as a bulwark in maintaining food security and, in the process, national security as well.

Besides, the allied sectors like horticulture, animal husbandry, dairy and fisheries have an important role in improving the overall economic conditions and health and nutrition of the rural masses. To maintain the ecological balance, there is need for sustainable and balanced development of both agriculture and the allied sectors. The Tenth Plan—in fact, every one of the Five Year Plans—brought out the crucial role of the agricultural sector in enabling the widest dispersal of economic benefits and emphasised that “*agricultural development is central to economic development of the country.*”

Agricultural Development Essential for Economic Growth

The significance of agriculture in India arises also from the fact that the development in agriculture is an essential condition for the development of the national

economy. Ragnar Nurkse argues that the surplus population in agriculture should be shifted to the newly started industries. Nurkse's thesis is that agricultural productivity will be increased on the one hand and on the other new industrial units would be set up with the use of surplus labour.

The Nurksian thesis, though widely welcomed at one time, has been questioned recently:

(a) Industrialisation does not consist only of shifting of workers from agriculture to industries. It requires a particular set of motives and values which an agricultural economy cannot supply. A change in agriculture itself is essential before such motivations and values are evolved.

(b) The marketable agricultural surplus will have to be increased considerably to feed the growing urban population and to provide raw materials to industries.

(c) New uses have been discovered for foodgrains and other agricultural crops. With fossil oils becoming increasingly expensive, ethanol is being used as an alternative fuel. Corn, sugarcane, beetroot and other crops are increasingly converted into ethanol and alcohol.

(d) The new industries and the fast growing services sector, however fast they may develop, will not be able to provide adequate employment for the ever-growing millions in India. There is a limit to the capacity of employment in industries in the short period. Necessarily, therefore, increased employment will have to be found in agriculture and in rural industries.

In other words, rapid economic development will require rapid agricultural development either to precede or to go hand in hand with it. Indian planners learnt a bitter lesson during the Second and Third Five-Year Plan periods and in recent years, during 2002-03, for example, when failure of the agricultural sector spelt disaster to the entire planning process.

Thus, any change in the agricultural sector—positive or negative—has a multiplier effect on the entire economy. The agricultural sector acts as a bulwark in maintaining food security and in the process, national security as well. Recognising the crucial role played by the agricultural sector in enabling the widest dispersal of economic benefits, the Tenth Plan emphasised that *“agricultural development is central to rapid economic development of the country.”*

The unfortunate thing is that most of the economic plans failed continuously to achieve agricultural targets. In fact, agricultural development has always been given lower priority at the expense of industries and service sectors.



On the eve of independence, the future was in a hopeless state. Farmers were in heavy debts and were at the mercy of money lenders. They were half-starved and had no proper equipment, gourds, etc. Except in certain seasons, agriculture was dependent upon rainfall. Productivity was very low and had been declining at a rapid rate. In spite of the increase in working population, the country was not self-sufficient to depend on imports. The partition of the country worsened the agricultural situation, as India lost a large amount of less land to support its growing population.

Objectives of economic development of agriculture

While planning the Tenth Five-Year Plan, the Planning Commission had three main objectives in view:

(a) **Increase agricultural production**—This has always been

- (i) to bring more land under cultivation
- (ii) raise the per hectare yield by application of such as fertilisers, improved seeds, etc.
- (iii) bring about better organisation of agriculture.

(b) **Increase employment opportunities**—This is from increase in production of foodgrains to generate additional employment opportunities and provide scope for income-generating activities in sections in our villages.

(c) **Reduce the dependence on foreign countries**—Another basic objective of the Tenth Five-Year Plan was to reduce the dependence of the country on foreign countries for foodgrains. The agricultural sector has been encouraged to work on land, on the basis that a large number of people working on land should be shifted to non-farm activities, preferably in rural areas.

(d) **Reduce inequality in agriculture**—The Government has decided to give more attention to the problems of tenants, and should encourage them to become marginal farmers in some degree of equality.



2. PROGRESS OF AGRICULTURE UNDER THE FIVE-YEAR PLANS

On the eve of the First Plan (1951-56), agriculture was in a hopeless and deplorable condition. Our farmers were in heavy debt to the village money-lenders. They were having small and scattered holdings. They had neither the money nor the knowledge to use proper equipment, good seeds and chemical manures. Except in certain selected irrigated areas, they were dependent upon rainfall and upon the vagaries of the monsoons. Productivity of land as well as of labour had been declining and was generally the lowest in the world. In spite of the fact that over 70 per cent of our working population was engaged in cultivation, the country was not self-sufficient in foodgrains but had to depend on imports of foodgrains. Besides, the partition of the country in 1947 worsened the agricultural situation, as India was allotted more people but less land to support them.

Objectives of economic planning for the agricultural sector

While planning to develop the agricultural sector, the Planning Commission has generally kept four broad objectives in view :

(a) **Increase agricultural production**.—The aim has always been

- (i) to bring more land under cultivation,
- (ii) raise the per hectare yield through intensive application of such agricultural inputs as irrigation, improved seeds, fertilisers, etc. and thus
- (iii) bring about increased agricultural production.

(b) **Increase employment opportunities**.—Apart from increase in production, the agricultural sector has to generate additional employment opportunities and provide scope for increasing the incomes of the poorer sections in our villages.

(c) **Reduce the pressure of population on land**.—Another basic objective of planning in the agricultural sector has been to reduce the number of people working on land, on the assumption that there are too many people working on land. The surplus labour on land should be shifted to secondary and tertiary sectors, preferably in rural and semi-urban areas.

(d) **Reduce inequality of incomes in the rural sector**.—The Government should remove the exploitation of tenants, and should distribute surplus land among small and marginal farmers in such a way that there would be some degree of equality and justice in the rural areas.

All these four objectives are generally followed in all our five year plans but in practice, agricultural planning in India has come to mean increase in agricultural production, viz., the achievement of the first objective; all other objectives have either been ignored or given lower priority.

Strategy used in the agricultural sector

To bring about increase in agricultural production and also increase in rural employment, the Five Year Plans use various programmes such as: setting up of community development programmes and agricultural extension services throughout the country, expansion of irrigation facilities, fertilisers, pesticides, agricultural machinery, high-yielding varieties of seeds and expansion of transportation, power, marketing and of institutional credit.

To reduce the pressure of population on land, the strategy used by the Planning Commission was rural development *i.e.*, set up agro-based industries and handicrafts in rural areas, to promote rural transport and communications and to encourage the movement of people from agriculture to industries and service sectors.

Finally, to bring about equality and justice in rural India, the strategy used by the Planning Commission was land reforms which included the removal of intermediaries, like the Zamindars, the protection of tenants through tenancy legislation, ceiling of land holdings and distribution of surplus land among landless labourers and small and marginal farmers.

Pattern of investment in the agricultural sector

At the outset, a word of explanation is necessary about the meaning and content of "agricultural sector". In the first three Plans, "agricultural sector" was composed of agriculture and allied sectors (horticulture, animal husbandry and fisheries) and irrigation and flood control. In the successive Plans, "rural development" and "special area programmes, were added and "irrigation and flood control" was omitted. In Table 4, outlay on agriculture is composed of agriculture and allied sectors, special area programmes and rural development, irrigation and flood control.

It would be clear that the total outlay in each Plan had increased and, correspondingly, the outlay on agriculture allied sectors had also increased. However, the percentage of plan outlay on agriculture and allied sectors to total plan outlay varied between 31 per cent and 14.9 per cent from the First Plan to the Tenth Plan.

**TABLE 4. Pattern of Government Outlay on Agriculture and Allied Sectors
(₹ crores)**

Plans	Periods	Total Plan Expenditure (Actual)	Agriculture and allied sectors	%age of agriculture and allied sectors to total outlay
I Plan (Actual)	1951-56	1,960	600	31
II Plan "	1956-61	4,670	950	20
III Plan "	1961-66	8,580	1,750	21
IV Plan "	1969-74	15,800	3,670	24
V Plan "	1974-79	39,430	8,740	22
VI Plan "	1980-85	1,09,300	26,100	24
VII Plan "	1985-90	2,18,730	47,100	23
VIII Plan "	1992-97	4,75,480	1,01,590	21
IX Plan "	1997-02	8,59,200	1,76,217	20.5
X Plan "	2002-07	15,25,639	3,05,055	20.0
XI Plan (Plan)	2007-12	36,44,718	6,74,105	18.5

SOURCE : Planning Commission, Various *Five-Year Plan Documents, Economic Survey, 2006-07 (Tables) and Eleventh Five Year Plan (2007-12)*

The Indian Planning Commission specified various programmes for increasing agricultural production such as irrigation, soil conservation, dry farming and land reclamation, supply of fertilisers and manures, improved agricultural implements, adoption of scientific practices, etc. The Government gave considerable attention to institutional changes such as the setting up of community development programme and agricultural extension services throughout the country, the use of land reforms, expansion of rural transportation, power, marketing and other basic facilities, improvement of the system of co-operative credit, etc. From the Third Plan onwards, the greatest emphasis was laid on irrigation-fertilizer-seed technology which led to the green revolution.

Actual outlay on the agricultural sector ranged between 18 and 24 per cent of the total Plan outlay (except during the first Plan, it was as high as 31 per cent). During Eleventh Plan it has declined to only 18.5 percent.

We shall describe the progress made by India in the field of agriculture under the first nine plans. In the next section, we shall take up the progress of agriculture under the Tenth Plan separately.

Agricultural Progress under the Five Year Plans : Brief Summary

First three Plans (1951-61)

The First Five Plan (1951-56) aimed at solving the food crisis India was facing at that time and also ease the critical agricultural raw material situation, particularly the acute shortage of raw cotton and raw jute. Accordingly, the First Plan gave the highest priority

to agriculture, specially food production, by allotting 31 per cent of the total Plan outlay on agriculture.

The production target in foodgrains during the First Plan was exceeded—for instance, as against the target of about 62 million tonnes, actual production of foodgrains came to nearly 67 million tonnes (Table 4). However, the targets fixed for sugarcane, cotton and jute were not achieved.

The Planning Commission wanted the Second Plan to lay the foundations of industrialisation. Out of total outlay of ₹ 4,600 crores during the Second Plan, a sum of ₹ 950 crores or about 20 per cent was spent on agriculture. Despite the percentage reduction in Plan outlay on agriculture, the progress on the agricultural front was significant. For example, foodgrain production recorded nearly 80 million tonnes in 1960-61, as against the target of 81 million tonnes. Likewise, the production of oilseeds, sugarcane and cotton was much more in 1960-61 than in 1955-56. There was, however, a shortfall in the production of all groups of commodities, as against the target fixed, except in the case of sugarcane in which there was remarkable progress.

Experience in the Second Plan had showed clearly that the rate of growth in agricultural production was a major limiting factor in the progress of the Indian economy.

As the Government felt that the success of the agricultural sector was an essential condition for the success of the entire Plan, the Third Plan fixed ambitious targets of production for all agricultural crops.

Plans	Periods	Total Plan Expenditure (Actual)	Agriculture and allied sectors	%age of agriculture and allied sectors to total outlay
First Plan	1951-56	1,960	600	31
Second Plan	1956-61	4,670	950	20
Third Plan	1961-66	8,580	1,750	21
Fourth Plan	1966-71	15,800	3,670	24
Fifth Plan	1971-76	39,430	8,740	22
Sixth Plan	1976-81	1,09,300	26,100	24
Seventh Plan	1981-86	2,18,730	47,100	23
Eighth Plan	1986-91	4,75,480	1,01,590	21
Ninth Plan	1991-96	8,59,200	1,76,217	20.5
Tenth Plan	1996-2001	15,25,639	3,05,055	20.0
XI Plan (Plan)	2001-06	36,44,718	6,74,105	18.5

Note : 1. Production

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SOURCE : Plan document

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TABLE 5 : Achievements in the Agricultural Sector in the Various Plans

	Foodgrains		Oilseeds		Sugarcane		Cotton		Jute	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual
First Plan	62	67	5.5	5.6	63	60	4.2	4.0	5.4	4.2
Second Plan	81	80	7.6	6.5	78	104	6.5	5.4	6.5	4.0
Third Plan	100	72	9.8	6.4	100	127	7.0	4.6	6.2	4.5
Fourth Plan	129	104	10.5	8.7	150	140	8.0	5.8	7.4	6.2
Fifth Plan	125	132	12.0	8.9	165	165	8.0	7.1	7.7	7.1
Sixth Plan	154	146	11.1	13.0	215	170	9.2	8.5	9.1	7.8
Seventh Plan	180	171	18.0	17.0	217	210	9.5	10.5	9.5	7.9
Eighth Plan	210	199	23.0	25.0	275	277	14.0	14.3	9.5	11.0
Ninth Plan	234	211	30.0	20.7	336	300	15.7	10.1	—	11.6
Tenth Plan	234	216	30.0	24.0	336	345	16.0	23.0	—	11.0

Note : 1. Production of foodgrains, oilseeds and sugarcane in million tonnes.
 2. Production of cotton in millions of bales of 180 Kgs each.
 3. Production of jute in millions of bales of 170 kgs each.

SOURCE : Plan documents and *Economic Surveys*.

The Government introduced the new agricultural technology known as Intensive Agricultural District Programme (IADP), which was soon followed by a programme of using improved seeds, viz., High Yielding Varieties Programme (HYVP). The new agricultural technology was expected to usher in the green revolution. However, as a result of the extensive and serious drought conditions in 1965-66, agricultural production was adversely affected. (Table 4).

(a) None of the agricultural targets—except sugarcane—was achieved during the Third Plan period; and

(b) The actual output at the end of the Third Plan in the case of foodgrains, oilseeds and raw cotton was lower than the output at the end of the Second Plan, indicating that the Third Plan was a wash-out as far as agriculture was concerned.

As a consequence of the shortfall in food production and serious famine conditions in many parts of the country, the Government was forced to import foodgrains extensively during the last year of the Third Plan. Besides, *for the first time, the public lost interest in the planning process and the Government adopted "plan holiday" for three years*.

The experience of the Third Plan made the Planning Commission realise the bitter fact that *economic planning would be a failure unless agricultural production was increased rapidly*. Accordingly, the Planning Commission assigned high priority to agriculture in the successive plans.

Progress from the Fourth Plan Onwards

The approach paper to the Fourth Plan emphasised the necessity to create favourable economic conditions for the promotion of agriculture and a

systematic effort to extend the application of science and technology to improve agricultural practices. Ambitious targets were fixed for the Fourth Plan.

Table 5, however, reveals clearly that none of the targets fixed in agriculture in the Fourth Plan was realised. For example, the target for foodgrains was 129 million tonnes for 1973-74 but the actual production in that year was only 104 million tonnes—the highest level of production during the Fourth Plan was 108 million in 1970-71.

Consider further the targets fixed and actual production of oilseeds, sugarcane, cotton and jute during the Fourth Plan. It would be clear that the Fourth Plan failed to achieve the agricultural targets.

The Fifth Plan (1974-1979) was prepared with great care, with total Plan outlay at ₹ 39,430 crores out of which outlay on agriculture and allied sectors would be ₹ 8,740 crores (which was 24 per cent of the total Plan outlay). The targets for production of various crops and the necessary inputs to achieve these targets were also clearly set out. Unfortunately, all the financial calculations went wrong because of the serious inflationary situation during 1973-74. However, after the declaration of emergency (1975) agricultural progress was steady and plan targets were almost realized.

The Janata Party which came to power in 1977, however, suspended the Fifth Plan midway – rather foolishly – and started preparing the Sixth Plan. It will be clear from Table 4 that the actual production of foodgrains in the last year (1978-79) of the Fifth Plan was 132 million tonnes, as against the target of 125 million tonnes. In fact, apart from the First Plan the Fifth Plan was the only period when the actual production of foodgrains exceeded the targeted production.

Progress since the Sixth Plan

Of all the Plans, the Sixth Plan (1980-85) was hailed as a great success, particularly because of the success on the agricultural front. As against the annual growth rate of 3.8 per cent for agriculture, the actual growth rate was 4.3 per cent. The production of foodgrains in 1983-84 was 152 million tonnes (against the target of 154 million tonnes) and was hailed by the Indian Government as the *Second Green Revolution*. While the First Green Revolution from 1967-68 arose from the introduction of new high yielding varieties of Mexican wheat and dwarf rice varieties, the Second Green Revolution from 1983-84 was said to be from expansion in supplies of inputs and services to farmers, agricultural extension and better management.

While the First Green Revolution was confined mainly to Punjab, Haryana and Western U.P., the Second Green Revolution had spread to eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and eastern U.P. These states had made tremendous progress in recent years.

However, it is important to emphasise the fact that, despite all the great claims of the Government, none of the targets (except in oilseeds) of agricultural production was achieved during the Sixth Plan (Refer Table 4).

The Seventh Plan (1985-90), the Eighth Plan (1992-97) and the Ninth Plan (1997-2002) targeted 4 per cent annual rate of growth and laid emphasis on specific projects in the field of agriculture. They included a special rice production programme in the eastern region, national watershed programme for rainfed agriculture, national oilseeds development project, social forestry, etc.

The Seventh Plan was not successful in the sense that the targets fixed for various sectors (except cotton) were not achieved (see Table 4). However, the level of production at the end of the Seventh Plan was much higher than at the beginning of the Seventh Plan.

The Eighth Plan (1992-97) was basically sound in its approach in the strategy of development and in the targets of agricultural crops. Fortunately, weather and climate conditions were favourable and broadly many of the targets could be fulfilled. For instance, the actual outputs in 1996-97 (the last year of the Eighth Plan) of oilseeds, of sugar cane, of cotton and of jute were higher than the targets for these crops in the Eighth Plan. The only exception was foodgrains – the Eighth Plan target was 210 million tonnes but the actual production was 199 million tonnes. In fact, the production of foodgrains at 199 million tonnes was the highest output registered by India till then.

The Ninth Plan (1997-2002) was not much of a success, as far as the agricultural targets were concerned. For instance, the Ninth Plan fixed the target of foodgrain production at 234 million tonnes in 2001-02, but the actual production was only 211 million tonnes. The same story of under-achievement was to be noted in other sectors of agriculture also. One is again inclined to ask the question: why should the planners fix unrealistic and unrealisable targets?

Agriculture Sector Under the Tenth Plan

Growth Projection in the Tenth Plan

The Tenth Plan adopted the prescriptions of the National Agricultural Policy, 2000 (NAP, 2000). The Tenth Plan, particularly, emphasised the following types of growth envisaged by NAP, 2000.

- (i) growth that was based on efficient use of resources and conservation the soil, water and biodiversity of the country ;
- (ii) growth with equity i.e. growth which was widespread across regions and covered all farmers ;
- (iii) growth that was demand driven and catered to domestic markets as well as maximised benefits from exports of agricultural products in the face of the challenges arising from economic liberalisation and globalisation ; and
- (iv) growth that was sustainable technologically, environmentally and economically.

The NAP, 2000 envisaged a growth rate exceeding 4 per cent per annum in the agricultural sector. The Tenth Plan also targeted a 4 per cent rate of growth. Towards this purpose, the Tenth Plan visualised :

- (a) the estimated foodgrains requirement at the end of the Tenth Plan : 230 million tonnes.
- (b) the estimated supply position is expected to be between 225 and 243 million tonnes.

The Tenth Plan planned to achieve this volume of production of foodgrains through

- (i) adequate thrust on maize cultivation which has good scope for increasing production of minor cereals to 43 to 48 million tonnes ; and
- (ii) thrust on commercialisation of hybrid rice on a large scale and improved technologies in wheat.

Strategy and Thrust in the Tenth Plan

The Tenth Plan accepted the increasing biotic pressure on the natural resources in the country, especially land, water and biodiversity; with the increasing population, the fragmentation of holdings had increased,

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The Tenth Plan addressed this problem through:

- (a) easy transfers of agricultural land to enable farmers to augment their holdings to viable units ;
- (b) facilitate leasing and contract farming through more freedom to lease in and lease out.
- (c) developed technologies suitable to increase productivity of small and marginal holdings which constitute 78 per cent of all holdings and operate about 32 per cent of total agricultural area.

The second aspect of this strategy involved waste lands—estimated at 64 million hectares—and degraded areas which are either unutilised or underutilised estimated to cover 107 million hectares. All these lands are under the control of the Government or of Panchayats. The Tenth Plan proposed that :

- (a) all such lands under the control of the Government or the Panchayats would be parcelled out in viable units and allotted to landless, scheduled caste and scheduled tribe farmers, small and marginal farmers, retired defence personnel, and educated rural youth, for cultivation.
- (b) highly degraded wastelands, should be exclusively used for forestry, tree cropping and agro-forestry.
- (c) the areas under reserved forests but which are at present unutilised or under-utilised should be distributed to the resource poor, especially landless and marginal farmers, to produce grasses and fodder and medicinal and aromatics plants.
- (d) The Tenth Plan continued rain-water harvesting and conservation so as to increase productivity of rain-fed farmlands. *Rain water conservation and harvesting hold the key for sustainable development of rain-fed areas.* Such a programme should ensure that the minimum basic water needs of the rural communities are met.

In this connection, the Tenth Plan proposed to continue vigorously, minor irrigation development and the adoption of improved on-farm water management practices and also the use of water saving devices, such as sprinkler irrigation and trip irrigation system in low-rainfall areas.

In general, the Tenth Plan believed that current land and water-use practices in the country were unsustainable, less productive and impact adversely on regeneration of natural resources. Accordingly, for sustainable development of natural resources, the Tenth Plan would continue to pursue, as already mentioned, a regionally differentiated strategy based on agro-climatic conditions and land and water availability. The promotion of suitable cropping patterns formed an essential part of the Tenth Plan strategy.

- (e) The Tenth Plan envisaged a radical thrust in

crop diversification. Small and marginal farmers, by and large, give a prime place to cereals in the cropping system, even though Indian agriculture is moving rapidly towards commercialisation. The emphasis on cereals is due to consideration of food security, low risk and easy market access. Besides, the Government's minimum support price (MSP) policy, involving only three crops (paddy, wheat and sugarcane) has encouraged mono-cropping and even exploitation of natural resources in some areas. All this has happened in the face of severe shortage of pulses and oilseeds.

The Tenth Plan's new thrust was diversification towards high value and more remunerative crops, considering the agro-climatic conditions, endowment of land and water resources and the market demand both within the country and outside. The Tenth Plan emphasised the production of fruits, vegetables, flowers, agro-forestry, tree farming, animal husbandry, dairying, aquaculture, etc.

To encourage such activities, the Tenth Plan developed the necessary infrastructure for post-harvest handling, processing, storage, marketing, etc. and also promoted pro-active production policies to motivate farmers and entrepreneurs.

(f) The Tenth Plan set out radical schemes affecting production and distribution of quality seeds, fertilisers and plant nutrients, soil testing, farm implements and pest management.

(g) Finally, the Tenth Plan encouraged organic farming in a big way. The Plan appreciated the growing demand for organically produced food all over the world and the high prices they command. India is a low-chemical fertiliser using country, specially in the rain-fed areas, north eastern and hill areas. India has, thus, good opportunity to take up production of organic foods for exports and domestic use. In this connection, the Tenth Plan encouraged organic fertilisers use in agriculture by converting farm waste and municipal solid waste into good quality compost/manure.

Pattern of outlay on agriculture in the Tenth Plan

The Tenth Plan targeted 8 per cent rate of growth in GDP and accordingly, estimated the required level of investment (at 2001-02 prices) of ₹ 15,92,300 crores in the public sector – this was 67 per cent increase over the Ninth Plan outlay. As regards agriculture, the Tenth Plan set a target growth rate of 4 per cent per annum during the Plan period, and raised Plan allocations on agriculture and allied sectors, rural development, special area programmes and irrigation and flood control.

The public sector outlay on agriculture and allied activities irrigation and flood control, rural development and special area programme which was of the order of ₹ 1,76,217 crores in the Ninth Plan, increased to ₹ 3,05,055 crores in the Tenth Plan which was 20 per cent of the total

TABLE 6 : Plan Allocation on agriculture

	Ninth Plan		Tenth Plan		Eleventh Plan	
	Amount (₹ crores)	%	Amount (₹ crores)	%	Amount (₹ crores)	%
1. Agriculture and allied activities, rural development, special area Irrigation and flood control	1,76,217m	20.5	3,05,055	20.0	6,74,105	18.5
2. Total Plan outlay	8,59,200	100.0	15,25,639	100.0	36,44,718	100.0

SOURCE : *Tenth Five Year Plan*, 2002-07 ; Vol. II. and *Eleventh Five Year Plan* (2007-12) Vol. I.

Note : Tenth and Eleventh Plan figures are at 2006-07 prices.

Plan outlay ; this was almost the same as that in the Ninth Plan. In fact, as emphasised earlier, public sector outlay on agriculture irrigation and others has ranged between around 20 and 24 per cent of the total outlay in all the Plans. It may be noted that if we take agriculture and allied activities alone, public sector outlay has been hardly 4.9 percent of total outlay in ninth plan, 3.9 percent in tenth plan proposed expenditure an agricultural and allied activities in merely 3.7 percent of total plan outlay in 11th plan.

Targets of Crop Production in the Tenth Plan

The Tenth Plan was the first Plan which did not fix targets of crop production.

For every Plan, the Planning Commission used to fix

(a) the rate of growth in the agricultural sector as a whole,

(b) the planned target growth of production in each major crop viz., cereals, pulses, oilseeds, sugarcane, cotton, jute and so on.

(c) the targets of production of major inputs such as seeds, fertilisers, irrigation etc., and

(d) the strategy to be adopted to achieve the targets of crop production in general and the rate of growth in agriculture in particular.

The Tenth Plan was a clear departure from this traditional presentation. It described the achievement/non-achievement of the Ninth Plan (Table 7).

The Planning Commission must have been clearly ashamed of its target projections in the Ninth Plan. It is

clear from Table 6 that the actual production of foodgrains for the year 2001-02 (final year of the Ninth Plan) was 212 million tonnes, as against the planned target of 234 million tonnes — a huge shortfall of 22 million tonnes. In the case of oilseeds the actual output in 2001-02 was 21 million tonnes as against the targeted figure of 30 million tonnes. This was also the case of sugarcane and cotton.

What was really pathetic was that the actual production of oilseeds and cotton during the Ninth Plan was not only less than the target production but *less than the base level (1996-97) output*. This was definitely negative rate of growth. It is unfortunate that we could not achieve Ninth plan targets even at the end of Tenth Plan.

Table 7 gives agricultural achievement during 9th and 10th Plans. During the Tenth Plan period (2002-07), foodgrain production had increased to 216 million tonnes – it may be mentioned that the target of foodgrain production was fixed at 234 million tonnes for the Ninth Plan period (2001-02). There was, however, clear growth in oilseeds, sugarcane and cotton. In general, it is estimated that the annual rate of growth in agriculture was 2.3 per cent, as against the targeted 4 per cent.

Agriculture in the Eleventh Plan (2007-12)

During the 11th Plan also, the Planning Commission has fixed the target of 4 per cent, rate of growth in agriculture, as if this is the first time such a "high" rate of growth has been fixed. The Planning Commission has appointed a special Agricultural Commission to monitor this rate of growth.

TABLE 7 : Crop Production During Ninth and Tenth Plans

Crop	Base Level (1996-97) Output	Plan Target (2001-02)	Actual Output	
			in 2001-02	2006-07
All foodgrains (m. tonnes)	199	234	213	216
Oilseeds (m. tonnes)	24	30	21	24
Sugarcane (m. tonnes)	278	336	297	345
Cotton (m. bales of 170 kg.)	14	16	10	23

SOURCE: *Five Year Plan documents and Economic Survey*, 2008-09 and Ministry of Agriculture.

*3rd Advance Estimates

1. Foodgrains (m. tonnes)
2. Rice (m. tonnes)
3. Wheat (m. tonnes)
4. Oilseeds (m. tonnes)
5. Sugarcane (m. tonnes)
6. Cotton* (m. tonnes)
7. Jute & mesta** (m. tonnes)
8. Potato (m. tonnes)

SOURCE : *Economic Survey*, 2008-09

The corporate sector has come forward for contract farming in the last few years. It is encouraged to provide better marketing. At the same time, there is a need for encouraging the setting up of small and medium scale industries and service units. There is a lot of confusion in the agricultural sector.

The volatile vagueness of the targets from year to year shows that the planning of Indian agriculture. The future is a gamble in the random manner. In nearly six decades of planning, the agricultural planning has been erratic.

The data pertaining to the Ninth and Tenth Plans newed efforts to boost agricultural production and concrete results. Total foodgrain production increased to the order of 242 million tonnes, while rice production touched 216 million tonnes, coarse cereals 22 million tonnes, oil seeds and pulses 24 million tonnes. It appears that the situation is in a difficult corner. There is a need to review the agricultural policy.

After showing a steady decline in the production of different crops, crops like cotton, pulses, oilseeds and sugarcane have shown a steady increase in all crops except rice in the last few years.

Progress of Agriculture

So, far we have seen the progress made under each Five Year Plan. The overall progress of agriculture as a whole and the progress of the agricultural sector in each state brings out the tremendous achievements achieved since the First Plan. The rate of growth fixed in each Plan might be compared with the rate of growth in each Plan.

Between 1950-51 and 2006-07, foodgrains had increased by 10 times, oilseeds by 5 times, sugarcane by 8 times. The increase in cotton production is really spectacular—by 10 times.

TABLE 8. Some key Indicators of Agricultural Progress

										Ratio between 1950-51 & 2010-11
			1950-51	1964-65	1990-91	2007-08	2008-09	2009-10	2010-11	
Eleventh Plan	Amount (₹ crores)	%								
6,74,105	18.5									
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al production of foodgrains of the Ninth Plan) was 212 anned target of 234 million million tonnes. In the case 2001-02 was 21 million ure of 30 million tonnes. cane and cotton. etic was that the actual ton during the Ninth Plan t production but less than put. This was definitely ortunate that we could not n at the end of Tenth Plan. al achievement during 9 th Plan period (2002-07), increased to 216 million that the target of foodgrain million tonnes for the Ninth was, however, clear growth on. In general, it is estimated h in agriculture was 2.3 per 4 per cent.										
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213 21 297 10	216 24 345 23									

SOURCE: *Economic Survey*, 2009-10. Note : * Cotton : million bales of : 170 kg

Agricultural Statistics At a Glance, 2010 ** Jute : " " of : 180 kg

The corporate sector is actively encouraged to go for contract farming in fruits, vegetables and other crops. It is encouraged to provide seeds, fertilisers and assured marketing. At the same time, the Government is encouraging the setting up of Special Economic Zones (SEZ) by buying large tracts of agricultural land for setting up industries and service sectors. There is considerable confusion in the agricultural sector in India.

The volatile variation in crop production from year to year shows that there is very little planning in Indian agriculture. The old saying that "Indian agriculture is a gamble in the rains" holds good even today, after nearly six decades of planning. In simple terms, agricultural planning has been a failure.

The data pertaining to 2010-11 reveals that renewed efforts to boost agricultural production has shown concrete results. Total foodgrains production will be of the order of 242 million tonnes – a record upto this time. Rice production touches 96 m. tonnes, wheat 86 m. tonnes, coarse cereals 42 m tonnes and pulse 18 m. tonnes. Oil seeds and cotton have also yielded higher production. It appears that agriculture is turning the corner. There is a need to strengthen this process further.

After showing improvement in production of different crops, crops failure in different crops affected all crops except rice in 2008-09.

Progress of Agriculture since 1951

So, far we have explained agricultural progress under each Five Year Plan. We shall give the progress of agriculture as a whole during the last 58 years. The progress of the agricultural sector, summarised in Table 8, brings out the tremendous progress the country has achieved since the First Plan, *even though, the targets fixed in each Plan might not have been fully met*.

Between 1950-51 and 2009-10, production of foodgrains had increased by 4.3 times, production of oilseeds by 5 times, sugarcane by 4.9 times and cotton by over 8 times. The increase in production of wheat has been really spectacular—by 13.5 times.

Table 9 gives the annual compound rate of growth since planning was introduced in 1951. During the first decade of planning (1951-61) when the First and Second Five Year Plans were implemented, the annual rate of growth in agriculture was 3.3 per cent. During the next two decades of planning in 1961-81, despite spectacular progress achieved under the new agricultural strategy and IADP and HYVP, the overall progress in agriculture was dismal; the annual average rate of growth declined to 2.2 per cent and 1.7 per cent respectively.

But conditions improved during the fourth decade of planning (1981-91). The growth rate in the 1980s was highly respectable (3.9 per cent). The compound growth rate for the period 1991-2001 was 2.8 per cent. Since then, specially during 2002-03, agricultural production declined deeply—negative rate of growth of 7 per cent. There was some improvement in agricultural growth but much lower than the targeted 4 per cent per annum. The Tenth Plan fixed a target rate of growth of 4 per cent in agriculture to achieve 8 per cent rate of growth in GDP. Indian agriculture growth was merely 2.1 per cent during the Tenth Plan.

TABLE 9 : Growth of the Agricultural Sector since 1950-51

Period	In Agriculture and allied sector	GDP
1951-61	3.3	3.8
1961-71	2.2	3.7
1971-81	1.7	3.3
1981-91	3.9	5.7
1991-01	2.8	6.7
2002-07	2.1	7.5
2005-11	3.1	7.0

SOURCE: 1. CMIE, *Basic Statistics Relating to Indian Economy*, Vol. I, August 1992, August 1994
2. *Eleventh Five Year Plan*, (2007-2012).
3. CSO, National Accounts Statistics, 2011

2. Rate of growth in yield since 1950-51. With the introduction of planning in 1950-51, there was rapid extension of irrigation and application of intensive

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methods of cultivation. After the introduction of modern agricultural practices including the adoption of hybrid seeds since 1964-65, there has been a steady and continuous increase in yield per hectare of all crops. Table 9 illustrates the yield of growth rates in India since 1950-51.

As it is not feasible and convenient to lump together yield per hectare of different crops under the group of "non-foodgrains", we have shown the yield per hectare, in selected years, for some selected crops. As mentioned earlier, monsoon and weather conditions affect average yield per hectare, and therefore, the variations in the yield per hectare reflect not only the effects of improved agricultural techniques but also that of natural factors, such as monsoon and weather conditions.

TABLE 10 : Per Hectare Yield of Principal Crops since 1950-51

	1950- 51	1964- 65	2010- 11
1. Foodgrains			
Rice (Quintals)	7.1	10.8	22.4
Wheat (Quintals)	6.6	9.1	29.4
Coarse cereals (Quintals)	4.3	5.1	14.18*
Pulses (Quintals)	4.0	5.2	6.9
2. Non-foodgrains			
Oilseeds (Quintals)	5.2	5.6	11.6
Sugarcane (Tonnes)	34	47	69
Cotton (Kgs)	95	122	510
Potato (Quintals)	66	84	203

* Figure for the year 2011-12.

Source: Economic survey, 2010-11, Agricultural Statistics at a Glance, 2008.

During the pre-green revolution period (1951-65), rice recorded the most impressive growth rate in yield--from 7 quintals per hectare in 1950-51 to nearly

11 quintals by 1964-65 (Table 10). The annual rate of growth was 2.1 per cent.

Yield per hectare in the case of wheat improved from 6.6 quintals in 1950-51 to 9.1 quintals in 1964-65, highest annual rate of growth of all crops among non-foodgrains, cotton and sugarcane recorded modest growth rates during this period.

During the second period of green revolution (1965-2010), however, the most spectacular growth rate was recorded by wheat (2.55 per cent per annum) potato too recorded an impressive growth rate of 1.87 per cent per year. Pulses recorded a growth rate of 0.42 per cent per year and oilseeds, a mere 1.2 per cent per year. This shows that the new bio-chemical technology was particularly suited to wheat production but was not effective in the case of other crops.

International Comparison of Agricultural Productivity

It will be useful to make a comparison of yield per hectare of some selected crops in India with that in other countries of the world so as to show how much India lags behind the other countries of the world.

Table 10 shows:

- (a) the actual yield per hectare of major food and non-food crops in India in the year 1999;
- (b) the actual yield in the country which is the largest producer of each specific crop; and
- (c) the highest yield per hectare in the world.

In the case of rice, the highest yield in the world is nearly 100 quintals per hectare recorded by Egypt. In the case of wheat, the highest yield is recorded by England - over 79.3 quintals per hectare.

China which is the single largest producer of both rice and wheat in the world records with average yields of 65.8 quintals and 47.4 quintals respectively.

TABLE 11 : Actual Yield per hectare in quintals during 2006 in Comparison with world's highest yield and yeilds of world's largest producer

Potential of high-yielding Indian varieties	Actual yield in India	Actual yield of the world's largest producer	Country	World's highest yield	Country	Quintals/hectare
				Country		
Food Crops						
Rice (Paddy)	40 to 58	31.9	65.8	China	100.0	Egypt
Wheat	60 to 68	29.1	47.4	China	79.3	UK
Maize	60 to 80	20.0	103.4	USA	103.4	USA
Non-food crops						
Sugarcane		644	789	Brazil	1214	Egypt
Groundnut (pods)	20 to 30	10.1	33.6	China	33.6	China

SOURCE : Agricultural Statistics at a Glance, 2011.

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	Quintals/hectare	Country
World's highest yield		
100.0	Egypt	
79.3	UK	
103.4	USA	
1214	Egypt	
33.6	China	

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Now, compare with average annual yield in India —only 31.9 quintals of rice and 29.1 quintals of wheat. Rice is India's major crop but the annual yield is less than one-third of that of Egypt and a little less than one-half of the annual yield of China.

Even in the case of wheat — the crop which has recorded the highest increase in India in the last 50 years — India's average annual yield is much lower as compared to the U.K. (world's highest yield in wheat) and China (world's largest producer of wheat).

In fact, when we compare carefully the average annual yield of every crop mentioned in Table 9, we find that the average yield in India generally ranges between 30 and 50 per cent only of the highest average yield in the world — this shows the enormous scope for, as well as challenge to, India to increase its annual yield. This fact demonstrates clearly that the increase in yield recorded by India under the green revolution and the introduction of modern technologies are not particularly unique to India; in fact, it is much less in India than the increase recorded by other developing countries like China.

In this connection Table 10 gives also *the potential annual yield* of high-yielding Indian varieties. For instance, against the actual yield of 30.0 quintals per hectare in rice, India has the potential to produce between 40 and 58 quintals of rice per hectare. In the case of wheat, India can produce up to 60 to 68 quintals, but the average yield is around 26 quintals per hectare. Even if we assume that India could register the minimum of the potential yield, the total output of rice in India should be 168 million tonnes per year (42 million hectares x 40 quintals or 4 tonnes per hectare); but the actual production of rice ranged between 82 and 93 million tonnes in between 1997 and 2007. Likewise, the total output of wheat in India should be 156 million tonnes (26 million hectares x 60 quintals or 6 tonnes per hectare); however, the actual production of wheat ranged between 69 and 75 million tonnes between 1997 and 2007.

It would thus be clear that if India could achieve the *minimum of potential yield* of only these two cereals, the total production would be around 324 million tonnes. It may be mentioned here that the total production of all cereals and pulses came to 199 million tonnes in 1996-97 and 213 million tonnes in 2006-07. The gap between the actual yield and potential yield in all our crops and the gap between the average yield in India and the average yield in many other countries of the world — these pose a challenge and an opportunity for India — vast scope for second and third green revolution.

Some agricultural economists have expressed their doubts about the possibility of India ever reaching the levels of yield attained in cold countries. There is no doubt that some scope of increasing yield exists, but to hope that it can be raised to 3 to 5 times is not feasible due to the fact that the semi-dwarf HYV varieties of wheat in India have a duration of 140 days, while in the cold countries long duration wheat crop of 10 months duration helps to obtain higher yields.

There is another point to remember here. In the span of a year, the Indian farmers can grow another rice crop or a crop of potato or legume or short-duration vegetables. Thus the farmer in India, by shifting from a mono-cropping to a multi-cropping system, is more concerned with the *over-all yield from all crops during a year*, rather than in terms of productivity per hectare of individual crops. Dr. M. S. Swaminathan, the eminent agricultural scientist, responsible for green revolution in India asserts: "It is unscientific to make comparisons purely on the basis of individual crops, but it would be more scientific to compare the cropping system as a whole." Obviously, the sharp differences shown in Table 10 do not take into account these factors.



3. PRESENT STATUS OF INDIAN AGRICULTURE: LOOMING AGRICULTURAL CRISIS

During the last 56 years of planning, India's agricultural development — more commonly called the Green Revolution — has been applauded the world over and many developing countries have started considering India their role model. Initially, India remained a food deficit country for almost two decades since Independence. But with the Green Revolution, India became not only self-sufficient in foodgrains but accumulated a huge food surplus — about 58 million tonnes in January 2002.

The agricultural situation started improving after the middle of 1960s with the introduction of high-yielding varieties (HYVs) of crops and the development of agriculture infrastructure for irrigation, credit, other input supply, storage and marketing. The high production potential, input-responsive HYVs motivated Indian farmers to adopt improved and modern technologies. The Government came out with minimum support prices (MSP) and procurement of agricultural commodities and expanded the storage, marketing and distribution of foodgrains at the national level.

The major factors for the all-round success of agriculture were : increase in the net area sown, expansion of irrigation facilities, land reforms, specially consolidation of land holdings — this was the first phase (1947-65) of agricultural development since Independence; development

and introduction of high-yielding seeds, extensive use of chemical fertilisers, pesticides and improved crop production technologies — this was the second phase (1965-85) of development in the agriculture sector; price policy based on MSP and procurement operations, infrastructure for storage/cold storage, increase in investments — this could be broadly called the third phase of agricultural development in India.

In spite of the spectacular achievements, various constraints and disturbing trends have always continued to hamper the requisite growth of the agricultural sector:

(i) Agriculture, Still a Gamble in the Monsoons.

Despite almost 6 decades of planning, agriculture in India has continued to be a gamble in the monsoons: failure of rainfall in some parts of the country and excessive rains and consequent floods in certain other areas of the country. It appears that the Planning Commission should have devoted more attention and more resources to the control of the vagaries of the monsoons. During the first decade of planning (1951-61) the main emphasis on extension of irrigation and in fact, even in the successive decades, considerable importance was given to the cumulative increase in the area brought under irrigation. In none of the Plans, however, the irrigation targets had been fulfilled. Besides, even the irrigation potential created during a plan was not fully utilised for various reasons.

(ii) Limited Use of New Agricultural Technology.

Since 1961, the emphasis shifted to the use of seed-fertiliser-water technology, known as the new agricultural strategy. But the new strategy succeeded only in wheat and to a small extent in rice; other food and non-food crops did not show perceptible improvement in production. Dry land cultivation was not touched at all by the new agricultural strategy.

(iii) Decline in Investment in Agriculture.

We have generally been given to understand that government investment was significant in boosting growth in agriculture. Besides, the role of the Government was not only to raise investment but also induce private investment in agriculture. The figures published by the Government in the *Economic Survey* are quite revealing (Table 12) :

In the early stages of technology breakthrough and green revolution, there was some improvement in private investment in farm assets like irrigation pumps, wells, tractors etc. Thereafter, private investment declined. Since 1980-81 however, there has been some buoyancy in private investment in agriculture — from 70% to 82%. The rising trend in private investment probably reflects the improved incentives for agriculture and favourable change in the trade policy.

**TABLE 12 : Gross Investment in Agriculture
(₹ Crores) (at 1980-81 prices)**

Year	Public	Private	Total	% Share	
				Public	Private
1960-61	590	1,080	1,670	35	65
1970-71	790	1,970	2,760	29	71
1980-81	1,800	2,840	4,640	39	61
1990-91	4,400	10,440	14,840	30	70
1999-00	6,670	41,480	50,150	17	83
2004-05	23,039	86,967	1,10,006	20	80
2008-09	24,452	1,14,145	1,38,597	18	82
2009-10	23,635	1,09,742	1,33,377	18	82
2010-11	NA	NA	1,42,254	18	82

Note: 1. The figures for 2004-05 onwards are based on 2004-05 prices.

2. The figures given by the Government of India are guesstimates. Figures from 1960-61 to 1980-81 are based on 1980-81 prices. Figures for 1990-91 and subsequent years are based on 1993-94 prices. Hence, these figures are not really comparable.

SOURCE : *Economic Survey 2011-12. Agricultural Statistics at a Glance (2011)*, Central Statistical Organisation.

The worrying aspect is that private investment in agriculture is almost completely concentrated in the northern regions particularly Punjab, Haryana and Western Uttar Pradesh and almost completely absent in other parts of the country.

Public investment, on the other hand, is a great disappointment. After showing an uptrend in the seventies, public investment in real terms (i.e. in 1980-81 prices) has generally declined — probably due to diversion of resources from investment to current expenditure in the form of increased inputs and input subsidies.

The share of agricultural sector's capital formation in GDP has been revolving around 2.7 percent to 3.3 percent in post reform period which is a disturbing phenomenon.

(iv) Failure of Land Reforms. Till the middle of the 1970s the Government hoped to implement land reforms, specially tenancy legislation and ceiling on land holdings. The Government failed to implement the land reform measures and there was very little of land redistribution in favour of marginal farmers and landless labourers or protection of tenants from exploitation or from eviction. The Government reconciled itself to its failure to push forth progressive land reforms and shifted the emphasis to technological changes. Since the Seventh Plan, for instance, there is no mention of land reforms. The bitter conflict between landlords and the landless in Bihar, Andhra Pradesh and other states — the rapid expansion of the Naxalite movement — is in the result of the failure to implement land reforms.

(v) Growing

the very beginning of agriculture were very limited. Investment in irrigation, land shaping and land reclamation, erosion and salinity control, research and extension services and provision of infrastructure for change is not a success story in agriculture. It is a story of institutional changes in agricultural growth, production as well as fusion. The fusion has not taken place, though technological progress in the field has accompanied by growing of rapid agricultural labourers have risen in Punjab and Haryana. This is being treated by the rich as an asset. Exploitation subsequently, the fruits are pocketed by the rich, leaving the growing agriculture and injustices.

(vi) Failure

of Land Reforms. The Government's failure to grow the growth of population, non-agricultural employment, those who could not own land, of land redistribution, of enlarging non-farm sector to grow faster than agriculture could, after a period of excessive pressure.

Basically, the

Government appreciates the failure of the transformation scheme to growth rate in agriculture for a decentralised approach with greater emphasis.

(vii) Unbalanced

Development. The increase in agricultural output has been concentrated in a few states which were already enjoying surplus foodgrains. As a result, the foodgrains had been exported, resulting in the accumulation of foreign exchange. The Government with its policies of import substitution and distribution of surplus foodgrains.

Many regions are still backward, indicating a

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(v) *Growing Exploitation of the Tenants*. From the very beginning, the growth prospects of Indian agriculture were vitally dependent on the role of public investment in irrigation, drainage and flood control, in land shaping and land consolidation, in prevention of soil erosion and salinity, in the development of a widespread research and extension network and in rural electrification and provision of institutional credit. But technological change is not a substitute for institutional change in agriculture. It is only a fusion of technological and institutional changes that can optimise the process of agricultural growth from the point of view of maximising production as well as distributive justice. However, this fusion has not taken place yet. As a result, the technological progress in the agricultural sector has been accompanied by growing inequality. Although as a consequence of rapid agricultural growth, the wages of agricultural labourers have risen in the green revolution areas of Punjab and Haryana. It has also been observed that land is being treated by the rich farmers as a very valuable asset. Exploitation of tenants has not declined and consequently, the fruits of agricultural progress are being pocketed by the rich peasantry. This is the paradox of growing agricultural production and growing inequalities and injustices.

(vi) *Failure to control growth of rural population*. The Government failed to arrest the rapid growth of population in rural areas and also to create non-agricultural employment in the rural sector so that those who could not be provided land in the programme of land redistribution could be provided non-agricultural employment to eke out a living. A programme of enlarging non-agricultural employment, if it could grow faster than the increase in total labour force, could, after a period of time, help to reduce the excessive pressure of population on land.

Basically, the Planning Commission failed to appreciate the fact that the process of agricultural transformation should emphasise not only higher growth rate in agriculture but should also stress the need for a decentralised industrial pattern of growth with greater emphasis on labour-intensive technology.

(vii) *Unbalanced agricultural development*. Bulk of the increase in output, particularly foodgrains had been concentrated in a few progressive regions which were already enjoying high levels of consumption of foodgrains. As a result, the marketable surplus of foodgrains had been rising at a high rate in these states resulting in the accumulation of large stocks with the Government with the attendant problems of storage and distribution and the cost of storage and distribution.

Many regions had continued to be poor and backward, indicating the necessity for a *balanced growth*

of agriculture as between different regions. Crop yields were low in these areas and, therefore, the use of modern inputs in these areas would raise agricultural productivity considerably.

Many classes of farmers, specially marginal and small farmers in the less developed areas, were having low levels of income. They used very little of modern inputs. More financial assistance to these farmers and greater encouragement to them to use modern inputs would have good output-response and rise of purchasing power of the rural poor.

Indian agriculture displayed another type of imbalance in the form of disparities in growth between foodgrains and non-foodgrains and between different foodgrains. Part of these inter-crop disparities in growth also reflected regional imbalance. For instance, a breakthrough in rice cultivation in the eastern region where the per hectare yield was low could bring about significant increase in rice production and remove the imbalance in growth between different foodgrains.

Likewise, a breakthrough in dry-land farming would help to raise the output of millets, pulses and oilseeds and thus help to correct inter-crop imbalance. Small and marginal farmers predominate in the dry-land farming regions and naturally, they will benefit most through watershed programmes and national pulse and oilseed development programmes.

The various weaknesses of the agricultural sector mentioned above indicate the main concerns and thrusts of the successive Five Year Plans. Outlining the strategies of agricultural development during the Seventh Plan, the Planning Commission wrote: "Broadening the base of agricultural growth and modernisation through infrastructure development e.g. irrigation, drainage, roads, markets and credit institutions in the less developed regions, extension of new technology, particularly breakthrough in dry-land farming, afforestation and appropriate price and procurement policies for crops are essential for accelerating the growth of agricultural output, reducing annual fluctuations in output and for correcting inter-regional, inter-crop and inter-class disparities. Such a pattern of growth can also provide the necessary impetus to rural development through the dispersal of agro-industries. This is how agriculture can contribute more effectively to the fulfilment of the national objectives of self-reliance, removal of poverty, increase in productivity and eco-preservation."¹

Looming Agricultural Crisis

The Planning Commission and the Government of India were aware — but not concerned — of the deceleration of the growth of agriculture in the 1990s — the over-

1. Planning Commission, *Seventh Five-Year Plan* (1985-90), Vol. I, p.2.

all growth rate of crop production declined from 3.7 per cent per annum to 2.3 per cent and productivity declined from nearly 3 per cent to 1.2 per cent. The deceleration of the growth rate in foodgrains was much steeper.

The NDA Government, however, was worried about the huge stocks of foodgrains in Government godowns and the heavy burden it involved. Much of the stock was sold to flour mills illegally. Over 10 million tonnes of foodgrains were exported. The buffer stocks of foodgrains built up so carefully over the years were frittered away. Even in June 2005, the Government claimed that India was "self sufficient in wheat". But the reality was the liquidation of as much as 60 million tonnes of buffer stocks in a period of three years, even in the midst of famine deaths in Orissa and Rajasthan.

The last two years of lean agricultural production with growing farmers' suicides all over the country has created a sense of panic in the country. Unprecedented hoarding of cereals and pulses by traders and huge rise in the prices of articles of daily consumption has forced the Government of India to resort to import of wheat for the first time in nearly three decades. As much as 5 million tonnes of wheat is being imported this year. This trend of large imports of wheat will continue in the years to come. The Agriculture Ministry officials are, however, unable to explain the sudden disappearance of foodgrain stocks. Four dangerous things are taking place in India now :

(a) Agricultural production is declining (Refer to Table 17 and note the annual production of foodgrains since 2001-02) ;

(b) The small and marginal farmers who have borrowed from money lenders, normally at the rate of 36 per cent per annum, are committing suicide in large numbers all over the country ; this is a clear failure of public sector banks and the Finance Ministry, which directs them;

(c) Prime agricultural land is being diverted all over India in the name of "development" by the government and passed on to powerful builders to construct highways, theme parks, IT parks, high-rise apartments, and so on.

(d) Rural poverty is growing in general, creating a sense of despair and anger among the rural poor.

India is now in a dangerous position. On the one hand, "India is shining" — that is, manufacturing and service sectors are growing and financial markets are booming. On the other hand, there is a suffering India and deepening gloom in the agricultural sector. The Second Green Revolution should come and come fast. The growing disparity in incomes and wealth between the urban and rural areas should be rapidly reduced. Otherwise, the growing rural poverty, misery and the consequent anger will surely destroy the "shining urban India".

In the 1990's, Soviet Russia disintegrated, not because of the American CIA but because of the continuous failure of Russian agriculture. The Indian planners should remember that one-third of India is already with

the Naxalites. This area is expanding day by day and not shrinking. This may spell the greatest danger to India's development.

4. GREEN REVOLUTION

New Agricultural Strategy

Since the mid-1960's, the traditional agricultural practices are gradually being replaced by modern technology and farm practices in India and a veritable revolution is taking place in our country. Initially, the new technology was tried in 1960-61 as a pilot project in seven districts and was called Intensive Agricultural District Programme (IADP). Later, the High-Yielding Varieties Programme (HYVP) was also added and the strategy was extended to cover the entire country. This strategy has been called by various names : modern agricultural technology, seed-fertiliser-water technology, or simply green revolution.

As a result of the new agricultural strategy, area under improved seeds has gone up since 1966. The new varieties are of a short-term duration and consequently, instead of growing one crop, two crops and sometimes, even three crops are grown. In the case of wheat, unprecedented enthusiasm has prevailed among farmers in Punjab, Haryana, Delhi, Rajasthan and Western U.P. for the new Mexican varieties like Lerma Rojo, Sonara-64, Kalyan and P.V. 18 and a situation developed in which the demand for seeds by the farmers exceeded the supply.

Traditional agriculture relies heavily on indigenous inputs such as the use of organic manures, seeds, simple ploughs and other primitive agricultural tools, bullocks, etc. Modern technology, on the other hand, consists of chemical fertilisers, pesticides, improved varieties of seeds including hybrid seeds, agricultural machinery, extensive irrigation, use of diesel and electric power, etc. Since 1966, the use of modern agricultural inputs has increased at a compound rate of 10 per cent per annum in contrast to the traditional inputs rising at the rate of only one per cent per annum during the same period.

The new agricultural technology uses such resources like fertilisers, pesticides, agricultural machinery, etc., which are produced outside the agricultural sector. As a result, industries supplying the modern farm inputs are growing at a rapid rate. Massive programmes of farm mechanisation and irrigation have also led to an increase in the consumption of electricity and diesel in rural areas.

The Case for New Strategy

The advocates of the new strategy considered the intensive approach as the only means of making

a breakthrough in India in the shortest possible time.

Agricultural inputs were increased to the extent possible to meet the needs of the population. The choice was between the use of chemical fertilisers and the inputs spread over a large area or the use of concentrated doses in a limited area. The latter choice, according to the advocates, was more rational as it ensured maximum output in a minimum period. Besides, the use of fertilisers was considered necessary to make the country self-sufficient in foodgrains in the shortest possible time.

It was further argued that if the use of fertilisers in large doses would be accompanied by irrigation, the yield per hectare and consequently, the output per unit area would be multiplied on economic grounds.

Large-scale demonstration plots were set up in actual field conditions in different parts of the country to adopt improved agricultural practices. This was followed by massive development projects and the green revolution became a beneficent cycle. In fact, the green revolution has transformed Indian agriculture.

Lastly, increasing the area under cultivation in certain regions would have far-reaching effects. For instance, the area under cultivation in the country would double in size and there would be a reduction in imports and thereby a saving of foreign exchange. This would free up resources for other sectors and would contribute to the expansion of industrial production.

Achievements of the Green Revolution

(i) *Boost to the production of major cereals*: The achievement of the new agricultural strategy in the production of major cereals gives the production of rice and wheat a new lease of life. The production of rice has increased from 61 million tonnes in 1966-67 to 99 million tonnes in 2004-05. The production of wheat through in this major cereal crop has also recorded a remarkable increase from 11 million tonnes in 1966-67 to 52 million tonnes in 2004-05.

TABLE 13 : Production of Major Cereals and Pulses in India

	Rice	Wheat	Coarse cereals
(a) Total Cereals	61	11	11
(b) Total Pulses	11	11	11
(c) Total foodgrains (a+b)	72	22	22

SOURCE : Ministry of Agriculture and Cooperatives, 2009, Economic Survey.

the traditional agriculture replaced by modern techniques in India and a place in our country, was tried in 1960-61 as a pilot project and was called Intensive Agricultural Development Programme (IADP). The strategy was extended to the entire country. This strategy includes: modern agriculture-water technology,

agricultural strategy, gone up since 1966. Long-term duration and one crop, two crops are grown. In the initial enthusiasm has spread in Jammu, Haryana, Delhi, and the new Mexican variety, Maran-64, Kalyan and beyond in which the production exceeded the supply. It depends heavily on indigenous manures, seeds, simple agricultural tools, etc., on the other hand, pesticides, improved seed varieties, agricultural use of diesel and kerosene, the use of modern agriculture at a compound rate of contrast to the traditional agriculture per cent per annum

Technology uses such chemicals, agricultural products produced outside the industries supplying the at a rapid rate. Massive land reclamation and irrigation have assumption of electricity

A strategy considered only means of making

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a breakthrough in Indian agriculture in the shortest possible time.

Agricultural inputs were scarce and it was not possible to meet the needs of the entire country in this respect. The choice was to have either a thin layer of the inputs spread over the entire country or to apply concentrated doses in selected and promising areas. The latter choice, according to the apologists, was more rational as it ensured maximum production in the short period. Besides, the urgent problem in the 1960s was to make the country self-sufficient in the shortest possible time.

It was further held that the application of high doses would be accompanied by increasing returns and consequently, such an application could be justified on economic grounds.

Large-scale demonstration of better cultivation in actual field conditions would induce farmers in other areas to adopt improved techniques. Thus, the intensive development programme would set in motion a beneficent cycle. In this way, the spread effect of the programme would raise overall level of productivity in Indian agriculture.

Lastly, increased agricultural production in a certain region would produce secondary and tertiary effects. For instance, the availability of more food in the country would decrease our dependence on food imports and thereby release scarce foreign exchange resources for other sections of the economy. Similarly, increased production of commercial crops would lead to the expansion of agro-based industries.

Achievements of the New Agricultural Strategy

(i) **Boost to the production of cereals.** The major achievement of the new strategy is to boost the production of major cereals, viz., wheat and rice. Table 13 gives the production of the principal food crops during the last 50 years. A close look at the table reveals the increase in rice production from 35 million tonnes in 1960-61 to 99 million tonnes in 2008-09, signifying a breakthrough in this major crop of India. (Due to bad monsoon rice production declined in 2009-10). The yield per hectare has also recorded an improvement from a little more than 11 quintals in 1960-61 to nearly 22 quintals now.

TABLE 13 : Progress in Foodgrain Production (million tonnes)

	1960-61	1990-91	2009-10	2010-11
Rice	35	75	89	96
Wheat	11	55	80.8	86
Coarse cereals	23	32	33.6	42
(a) Total Cereals	69	162	203.4	224
(b) Total Pulses	13	14	14.7	18
(c) Total foodgrains (a+b)	82	176	218.1	242

SOURCE : Ministry of Agriculture, Government of India, 2009, Economic survey 2010-11.

The production of wheat, which stood at 11 million tonnes in 1960-61, rose to 86 million tonnes in 2010-2011. Part of the increase in wheat production can be attributed to an extension of the area, but the yield per hectare rose from 8.5 quintals to 29.4 quintals per hectare, signifying 3.5 times rise in the last 50 years.

It is interesting to observe that the ratio of wheat to rice (Table 14) has steadily increased from one-third in 1960-61 to 84 per cent in 1999-2000. This means that, even though rice continues to be the most important cereal in the country, wheat is catching up fast.

TABLE 14 : Production of Rice and Wheat

Year	Rice (million tonnes)	Wheat (million tonnes)	Percentage of wheat to rice
1960-61	35	11	31
1980-81	54	36	67
1999-00	90	76	84
2006-07	93	75	81
2007-08	96	78	81
2008-09	99	81	82
2009-10	89	81	91
2010-11	96	86	90

SOURCE : Agricultural Statistics at a Glance, 2011. Economic Survey 2011-12

Green revolution did not cover coarse cereals like maize, jowar, barley, ragi, and minor millets. The green revolution did not cover pulses. The output of pulses fluctuated violently from year to year till it declined to an all time low of 8 million tonnes in 1979-80. From 13 million tonnes in 1960-61. Even now the production of pulses fluctuates between 13 and 15 million tonnes per year.

The green revolution was thus confined only to High Yielding Varieties (HYV) cereals, mainly rice, wheat, maize and jowar.

While rice output increased at a relatively slower rate, the singular crop which showed a continuously rising trend was wheat. This was true of potatoes. The very fact that the cash crops in general and pulses in particular have not so far been brought within the ambit of new technology forces the conclusion that quite a substantial part of the agricultural output has not even been touched by the green revolution.

(ii) **Increase in the production of commercial crops.** The green revolution was mainly directed to increase the production of foodgrains. It did not affect initially the production of commercial crops or cash crops such as sugarcane, cotton, jute, oilseeds and potatoes; these crops did not record any significant improvement initially. However, significant improvement in the output of sugarcane took place after 1973-74. Likewise, there was considerable improvement in the production of other cash crops such as oilseeds, potatoes etc. (Table 15).

TABLE 15 : Production of Cash Crops in India

	1960-61	1990-91	1999-2000	2008-2009	2009-2010
Oilseeds (m. tonnes)	7	19	21	28	31.1
Sugarcane (m. tonnes)	110	254	299	285	339.2
Cotton (m. bales)	6	10	12	22.3	33.4
Jute (m. bales)	4	8	11	10.4	10.6
Potatoes (m. tonnes)	3	15	25	29	36.6

SOURCE : Economic Survey, 2011-12.

(iii) **Significant changes in crop pattern.** As a result of the green revolution, the crop pattern in India has undergone two significant changes. Firstly, the output of cereals has risen at the rate of 3 to 4 per cent per annum but the output of pulses has remained stagnant or even declined. This has resulted in a decline in the importance of pulses in foodgrain output from 16 per cent in 1960-61 to 7.4 per cent in 2010-11. Cereals, on the other hand, have risen in importance from 84 per cent to 92.6 per cent during the same period. The *stagnant production of pulses* and the consequent rise in prices of pulses has a disastrous effect on the health of the poor who have generally given up the use of pulses – a major source of protein.

Secondly, among cereals, the proportion of rice in total cereal output has come down from 48 per cent to 43 percent between 1950-51 and 2010-2011. During the same period, however, the importance of wheat has more than doubled, i.e., from 15 per cent to 38 per cent (Table 16). The share of coarse grains has gone down from 37 per cent to 19 per cent of total cereals. The rising output of wheat indicates a substitution of coarse grains with wheat, on the side of production as well as consumption. This trend had begun even before the green revolution ushered in, but it has now strengthened.

TABLE 16. Percentage distribution of cereals output

Year	Rice	Wheat	Coarse grains	Total cereals
1950-51	48	15	37	100
1960-61	50	16	34	100
1990-91	46	34	20	100
2006-07	46	37	17	100
2007-08	45	36	19	100
2008-09	45	37	18	100
2009-10	44	40	16	100
2010-11	43	38	19	100

SOURCE : Economic Survey 2010-11, Agricultural Statistics at a Glance (2011).

(iv) **Boost to agricultural production and employment.** The successful adoption of the new agricultural technology has led to continuous expansion in area under crops, increase in total production and rise in agricultural productivity. Impressive results have been achieved in wheat, rice, maize, potatoes, etc. The adoption of new technology has also given a boost to

agricultural employment because of diverse job opportunities created by multiple cropping and shift towards hired workers. At the same time, there has been displacement of agricultural labour by the extensive use of agricultural machinery.

(v) **Forward and backward linkages strengthened.** The new technology and modernisation of agriculture have strengthened the linkages between agriculture and industry. Even under traditional agriculture, the forward linkage of agriculture with industry was always strong, since agriculture supplied many of the inputs of industry; but backward linkage of agriculture to industry — the former using the finished products of the latter was weak. Now, however, agricultural modernisation has created a larger demand for inputs produced and supplied by industries to agriculture and thus the backward linkage has also become quite strong. In this way, the linkage between agriculture and industry has got strengthened.

Weaknesses of the New Strategy

The new agricultural technology has made the farmer market-oriented. The farmers are largely dependent on the market for the supply of inputs and for the demand for their output. At the same time, the demand for agricultural credit has also increased as the new technology has increased the cash requirements of the farmer. Besides, modern technology has definitely proved its superiority over the traditional technology only in those areas where appropriate conditions prevail. But as mentioned above, these conditions prevail only in certain selected areas and the rest of the country is not yet suitable for advanced technology. What is, therefore, wanted is the evolution of a low-cost technology which can be adopted by all small farmers and which can use and exploit the local resources.

(1) **Indian Agriculture is still a gamble in the monsoons.** When the new agricultural strategy was introduced in the early 1960's, it was hoped that the trend of rising output of foodgrains would continue (Table 16). The then record achievement of 108 million tonnes of foodgrains in 1970-71 was hailed that green revolution had materialised and imports were immediately stopped. The euphoria was cut short in 1972-73 when production of foodgrains slumped to 95 million tonnes. Sharp fluctuations in foodgrain output were observed in the later years too. From a low level of about 100 million tonnes in 1974-75, foodgrains output rose gradually to 132 million tonnes in 1978-79. There was a steep decline in production just next year due to adverse weather conditions; foodgrains output in that year was 109 million tonnes in 1979-80 which was almost the same as 1970-71 output.

After many fluctuations, foodgrains rose to 176 million tonnes in 1980-81, touched 213 million tonnes in 1984-85, but the extensive drought conditions in 1988-89 declined steeply to 174 million tonnes. In 1990-91 (decline of 38 million tonnes), the output fell to 166 million tonnes in 2010-11, that the trend has been upward again. In 2011-12, the output touch a record level of 213 million tonnes. In the next year it again declined to 208 million tonnes.

TABLE 17: Trends in foodgrain production

Year	Production (in millions of tonnes)
1970-71	108
1978-79	132
1990-91	176
2001-02	213

SOURCE: Economic Survey 2011-12, Agricultural Statistics at a Glance (2011).

Two conclusions can be drawn from the fluctuations of output. First, the introduction of new agricultural technology is still subject to vagaries of nature; and

(a) Output of cereals and pulses is still subject to vagaries of weather; however, are now much more stable.

(2) Growth of Agriculture

Agriculture. The new agricultural strategy of IADP and HYVP has brought about a revolution in seeds, fertilisers, pesticides and other inputs. Investments are beyond the reach of medium farmers. In India, there are about 10 million farm households but only 40 per cent of them are making heavy investments in tubewells, pumping sets, tractors and other agricultural machinery required for modern agriculture. Capitalist farming in India is concentrated in the hands of a few rich population. The poor farmers directly benefited from the new agricultural strategy.

A recent study by the Indian Council for Research on International Affairs revealed evidence that the new farmers, comprising of young people, and urban-based migrants, have recently taken up agriculture. They constitute about 30 per cent of the farmers, command 8.1 per cent of the farms and cover 27 per cent of the agricultural land. It is this group of farmers who are called "new farmers" and "gentlemen farmers".

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New Strategy

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After many fluctuations, the output of foodgrains rose to 176 million tonnes in 1990-91 and touched 213 million tonnes in 2001-02. On account of extensive drought conditions, the output of foodgrains declined steeply to 174 million tonnes during 2002-03 (decline of 38 million tonnes in one year). It is only in 2010-11, that the trend has been reversed and foodgrain output touch a record level of 242 million tonnes. But in the next year it again plunged to 218 million tonnes.

TABLE 17: Trend in the production of foodgrains in India

(million tonnes)

Year	Production	Year	Production
1970-71	108	2002-03	174
1978-79	132	2003-04	212
1990-91	176	2006-07	216
2001-02	213	2007-08	231
		2008-09	235
		2009-10	218
		2010-11	242

SOURCE: *Economic Survey* (various issues). Agricultural Statistics at a Glance, 2011

Two conclusions can be drawn from the sharp fluctuations of output of cereals in India since the introduction of new agricultural strategy.

- (a) Output of cereals (as well as other agricultural products) is still subject to weather conditions as in the past; and
- (b) the maximum and minimum total outputs, however, are now much higher than in the past.

(2) Growth of Capitalistic Farming in Indian Agriculture. The new agricultural strategy consisting of IADP and HYVP necessitated heavy investment in seeds, fertilisers, pesticides and water. These heavy investments are beyond the capacity of small and medium farmers. In India, there are about 81 million farm households but just 6 per cent of the big farmers account for 40 per cent of all cultivated land; they alone are making heavy investment in the installation of tubewells, pumping sets, use of fertilisers and agricultural machinery required for the purpose. Consequently, the new agricultural strategy has helped the growth of capitalist farming in India and has led to concentration of wealth in the hands of the top 6 per cent of the rural population. The poor and marginal peasants have not directly benefited from green revolution.

A recent study of Punjab by Ashok Rudra and others revealed evidence of the growth of gentlemen farmers, comprising ex-servicemen, retired civil servants, and urban-based businessmen deriving their income from industry and commerce and who have recently taken up agriculture as an industry. In Punjab, they constitute about 3 per cent of the total number of farmers, command 8.5 per cent of the total number of farms and cover 27 per cent of the total cultivated area. It is this group of farmers called as "progressive farmers" and "gentlemen farmers" who are able to make huge

investments in the form of tractors, tubewells and pumping sets and other equipment.

The vast majority of rural households with little or no land, with poor finances and poor creditworthiness have not gone in for the new technology in a big way and have benefited the least from the green revolution. Regions which have been well endowed with resources (like Punjab, Haryana and Western U.P.) have benefited the most from the use of modern technology and have prospered. Other regions have remained backward and underdeveloped. Regional disparities have thus increased.

(3) Sidetracking the need for institutional reforms in Indian agriculture. The new agricultural strategy does not recognise the need for institutional reforms in agriculture. The bulk of the peasant population does not enjoy ownership rights. Large-scale evictions have already taken place. As a result, the tenants are being forced to accept the position of sharecroppers. Minhas and Srinivasan studied the effects of crop sharing arrangements in fertiliser use. Their basic assumption was that the cost of fertilizers was met by the cultivator by borrowing, and interest charges amounted to 10 per cent of the cost. Basing their judgement on the capitalist principle of profit maximisation, the owner-farmers reaped a profit of 180 per cent on irrigated lands in the case of wheat and 183 per cent in the case of rice. Against this, the tenant cultivators on a 50 per cent basis reaped a profit of only 65 per cent in wheat and 67 per cent in rice. The return was further reduced to a level of 42 per cent in the case of share-cropping on a 40 per cent basis. Profit maximisation criterion clearly indicates that larger dosages of fertilisers will be absorbed by owner farmers than by tenants. Thus, the conclusion is inescapable that tenancy cultivation poses itself as a big obstruction in the way of fertilizer use.

(4) Widening disparities in income. Technological changes in agriculture have had adverse effects on the distribution of income in rural areas. From his study of technological changes and distribution of gains in Indian agriculture, C.H. Hanumantha Rao concluded : "Technological changes have contributed to widening the disparities in income between different regions, between small and large farms and between landowners on the one hand and landless labourers and tenants on the other. In absolute terms, however, the gains from technological change have been shared by all sections. This is indicated by the rise in real wages and employment and in incomes of small farmers in regions experiencing technological change".²

(5) New Strategy and Socio-economic relations in rural areas. Francine Frankel, USAID ex-

2. C.H. Hanumantha Rao : *Technological Change and Distribution of Gains in Indian Agriculture* (1975), p. 178.

pert, undertook a study of the impact of the new strategy on the socio-economic relations of the peasantry. The main conclusions of this study are :

(a) Overwhelming majority of the cultivators having uneconomic holdings of 2-3 acres have managed to increase per acre yield from the application of small doses of fertilisers, but aggregate gains in output have been insufficient to create surplus capital for investment in land development.

(b) Often small and marginal farmers are forced to take some land on lease; in some cases, they are pure tenants. Rising rentals in recent years (in response to the sharp spurt in land values), and / or the tendency of landowner to resume land for personal cultivation (with the introduction of more profitable techniques), has actually led to an absolute deterioration in the economic condition of the small owner-cum-tenant cultivator class.

(c) Only the small minority of cultivators with holdings of ten acres or more have been in a position to mobilize surplus capital for investment in land development, especially minor irrigation, as an essential precondition for the efficient utilisation of modern inputs. Moreover, this class has prided its gains by using increased profits to buy more land, improve land already under cultivation, and purchase modern equipment.

(d) Farmers with twenty acres or more have made the greatest gains, partly by mechanising farm operations to take up double or multiple cropping, and partly by diversifying their cropping pattern to include more profitable commercial crops.

U Thant, a former U.N. Secretary-General warned developing countries : "There are many observers who contend that if left to market forces, the green revolution is likely to benefit primarily those farmers who are already engaged in commercial production rather than subsistence farmers, and among commercial farmers, big ones more than small producers." U Thant impressed upon the developing countries the urgent necessity to push through land reforms and bring about relative equality in land ownership.

The need for modifying policies focussing special attention on small farmers and backward regions is evident. In the words of Dr. V.K.R.V. Rao : "It is now well-known that the so-called green revolution which helped the country to raise its output of foodgrains has also been accompanied by a widening of the range of inequality in rural incomes, the loss of their status as tenants by a number of small farmers and the emergence of social and economic tensions in the countryside... the challenge which Indian agriculture faces is not only of production but also that of

3. V.K.R.V. Rao : "*New Challenges before Indian Agriculture*", Panse Memorial Lecture (April 1974)

distribution, and in our anxiety to concentrate on production problems, we should not forget the human and social implications of agricultural development."³ Land reforms are, therefore, unavoidable. Rapid growth of Naxalite movement in many parts of the country calls for justice for land distributions

(6) **Problems of labour displacement.** Very few studies are available to assess the impact of the mechanisation introduced under the garb of green revolution in terms of displacement of labour. Uma K. Srivastava, Robert W. Crown and Earl O. Heady have examined the effects of two types of technological innovations introduced under the Green Revolution — (i) biological and (ii) mechanical.

The term 'biological innovations' refers to the changes in inputs that increase productivity of land. The introduction of high yielding seed varieties and use of fertilisers, fall in this category. In this sense, green revolution is described as transformation of seed-fertiliser technology. The mechanical innovations refer to the introduction of new appliances which displace human or bullock labour. Thus, whereas biological innovations are labour-absorbing, mechanical innovations are labour-saving. It is therefore appropriate to describe the green revolution as a biological-mechanical revolution. It is the net effect of the labour-absorbing and labour-saving innovations which will determine the extent to which mechanisation need be introduced to check further displacement of labour. The study concludes : "Since mechanisation may dampen the increase in labour demand, resulting from the expanding factor of seed-fertilisers, the policies that encourage premature mechanisation in surplus labour economies, such as India's, do not seem conducive to solving the problem of growing unemployment."⁴

C.H. Hanumantha Rao brings out the favourable as well as unfavourable effects of new technology on employment : "If the Green Revolution is regarded as a package consisting of HYV and fertilisers, its contribution to employment has been substantial. Also, tubewells seem to have contributed significantly to the employment of labour" However, "the net employment of tractor-use may turn out to be negative when tractorisation of farm operations is complete. A harvest combine would displace farm labour on a large scale while its land augmenting effect would be negligible."⁵

Martin H. Billings and Arjan Singh have made

4. Uma Srivastava, Robert W. Crown and Earl O. Heady : "Green Revolution and Farm Income Distribution", *Economic and Political Weekly*, December 25, 1971.
5. C.H. Hanumantha Rao : *Technological Change and Distribution of Gains in Indian Agriculture* (1975), p. 121.

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to concentrate on progress and forget the human and rural development."³ This is unavoidable. Rapid growth in many parts of the world has led to land distributions

displacement. Very often the impact of the new technology is hidden under the garb of green revolution of labour. Uma K. Bhattacharya and Earl O. Heady have analysed the types of technological changes involved in the Green Revolution —

...the 'revolutions' refers to the productivity of land. The introduction of new seed varieties and new technologies in a category. In this sense, the 'revolution' is transformation of agriculture through mechanical innovations such as tractors, new appliances which reduce drudgery. Thus, whereas biological revolution is absorption, mechanical revolution is appropriation as a biological revolution. The net effect of the mechanical innovations which have been introduced is which mechanisation has led to further displacement of labour. Since mechanisation has increased labour demand, resulting in higher prices of seed-fertilisers, the effects of mechanisation in India's, do not seem to be positive in view of growing unemployment.

...the favourable impact of new technology on agriculture is regarded as substantial. However, the net effect turns out to be negative. The revolution is complete. A large number of farm labour on a large scale would be negatively affected.

Uma K. Bhattacharya and Earl O. Heady have made

Crown and Earl O. Heady, 'Farm Income and Political Weekly',

Technological Change and Agricultural Development (1975),

an attempt to quantify the labour-displacement effects in the wheat growing areas of Punjab with different degrees of mechanisation. The authors showed that 55 per cent of the total labour displaced was expected to be caused by tractors and pumpsets and 37 per cent by threshers and reapers. This analysis of Martin H. Billings and Arjan Singh emphasizes the fact that the technical changes that will successively gather momentum are bound to cause labour displacement. In other words, green revolution unaccompanied by a massive programme of "rural industrialisation" will cause nothing but frustration among the large mass of Indian peasantry. Unemployment or underemployment of agricultural labour might land us in a situation which might become explosive both politically and economically—rise of Naxalite movement in many parts of the country is a cause for serious worry.

Lessons from the Green revolution

Let us analyse the lessons of the experience of the Green Revolution embodied in the 'seed-fertiliser-irrigation' package.

1. The green revolution caused by the new strategy was initially limited to wheat, maize and bajra only. The major crop of India, i.e., rice, responded to the impact of the high-yielding varieties much later. Progress in major commercial crops, viz., oilseeds, cotton and jute is very slow. Further, pulses which account for about 10 per cent of the total food production have not registered any increase in production. It is really wrong to speak in terms of an agricultural revolution unless the projected upward trend in production in a few crops **becomes pervasive in all major crops.**

2. True, spectacular rise in foodgrain production has taken place since the 1960s in Punjab, Haryana, Western U.P. and in some selected districts of Andhra Pradesh, Maharashtra and Tamil Nadu. But these areas cannot claim to cover the bulk of India. All that can be said is that they have shown the way to a big take-off in agricultural production. In other words, the already better-off areas have made their economic position still better. This has initiated a process of unbalanced growth in India. The regions which have lagged behind have to catch up with those that have marched ahead. Unless all the major States enter the take-off stage, it would not be fair to speak of an agricultural revolution.

3. It has been observed that in the present rural set-up of co-operative societies and rural banks, it is the big farmer who is able to secure a loan at low rate of interest. The small farmer who wields very little influence in the village has to borrow from the village money-lender at exorbitant rates of interest varying

between 24 and 36 per cent. Whereas official agencies provide about 40 per cent of the total credit at cheaper rates and that, too, mostly to the big farmers, the tenant farmer and the small farmer who need credit at lower rates of interests, get the costliest credit. This introduces a difference in the real price of inputs to the large and the small farmers, obviously to the disadvantage of the latter.

4. The adoption of new technology depends upon control over water supply and ability of the farmer to regulate its timing. It requires lumpy investment in tubewells or diesel pumpsets. It has been observed that the ownership of tubewells was limited among farmers with ten acres or more. Obviously, there is need to develop a rental market for water supply. In order to accelerate the pace of new technology, availability of water should be ensured.

5. The new strategy has created three kinds of conflicts, namely, between large and small farmers, between owners and tenant farmers and between employers and employees on agricultural farms:

(a) The holders of large farms are capable of making heavy investment in the form of fertilizers, pumpsets, tubewells and agricultural machinery. They are also able to procure credit from banks and cooperatives societies and also obtain fertilizers and better seeds. For all practical purposes the large farmers enjoy the right of pre-emption of agricultural inputs and, thus, the small farmers are deprived of the much-needed inputs.

(b) In India quite a significant group of peasants have small size holdings and consequently, they hire land on tenancy from the large owners. Since the landlords pay for the new agricultural inputs, such farms are experiencing a dualism in agricultural production technique. The part of land hired by the tenants is provided with modern techniques and the small fragments of land owned by the tenants continue to be worked by traditional techniques. The conflict is the cause of social tension, more so when the landlords demand exploitative rents on the land leased out by them.

(c) The application of new technology in large farms has led to the substitution of human labour with mechanical processes. In other words, the back-wash effects of new strategy in terms of displacement of human labour have also to be taken note of. The greatest sufferers in the process of agricultural revolution are landless labourers. Unless alternative opportunities of employment are provided to this most vulnerable section of the rural community, agricultural revolution will be meaningless to the millions of landless peasants in this country.

In this context C.H. Hanumantha Rao argues that "participation in the modernisation process is

6. *Ibid.* p. 121.

usually greater in regions which have shed the feudal and semi-feudal structures and attitudes and where the inequalities in wealth and status are not conspicuous.”⁶ Hanumantha Rao cites the examples of Punjab, Haryana and western Uttar Pradesh where the technological change did not result in perceptible social tensions because real wages had risen in these regions. But such was not the case in Thanjavur in Tamil Nadu. The landlords in Thanjavur district tried to counter the demand for higher wages by bringing in farm labour from outside. For the success of the Green Revolution and its spread without social tensions, it would be advisable—rather it is absolutely necessary—to make a frontal attack on feudal and semi-feudal land relations.

Dr. M.S. Swaminathan, the eminent agricultural scientist, analysing the success of green revolution in Punjab stated : “The Green Revolution in Punjab is not a miracle. It happened only because the following pre-requisites for its success existed in the mid-Sixties: (a) Land consolidation and levelling, (b) Owner cultivation resulting in a long-term stake in land, (c) Rural communication, (d) Rural electrification and (e) A dynamic Agricultural University”.



5. NEW THRUST AREAS IN AGRICULTURE

As a consequence of the new agricultural technology, India has achieved relative self-sufficiency in foodgrains and its imports became negligible. India is also able to accumulate large buffer stocks of rice and wheat so that she could face any eventuality resulting from drought in a particular year or successively in two or three years.

But the achievements in agriculture cannot and should not make the Government complacent, because there are still many thrust areas in which we must orient our agricultural policies in the interests of agricultural growth with emphasis on sustainability and equity. Major thrust areas are the following :

(i) **Output and area under coarse cereals has shown negligible improvement.** Neither area nor production of coarse cereals showed any significant improvement. Sufficient attention was not paid so far to develop better HYV strains of these crops. Since major inputs were directed towards wheat and rice, coarse cereals remained neglected and to improve their production should be a major thrust area now.

(ii) **Stagnation in the output of pulses**—The production of pulses in 1970-71 was around 12 million tonnes. In 1990-91, the peak year of foodgrains production, production of pulses was 14 million tonnes. After 16 years in 2006-07 too the production of pulses is still 14 million tonnes. In most years, however, production has been stagnant around 13 to 14 million

tonnes. The per capita consumption of pulses, which was 69 gm per day in 1971, has come down to 36 to 37 gm now. This sharp decrease in the consumption of pulses is a cause of serious concern, more so for the poor for whom pulses are the major source of protein.

Pulses are mostly grown under unirrigated conditions on poor soils and with low inputs. Out of about 23 million hectares of area under pulses, only 2 to 3 million hectares are irrigated. Pulses do not require large doses of fertilizers and pesticides. The development of short duration varieties and improved dry farming technology has raised new hopes of raising the production of pulses. Researches over the last decade have produced new varieties of pigeon-pea (Arhar) which is ideally suited for poor farmers and it is possible to produce 2 to 3 tonnes per hectare of pulse besides 6 to 8 tonnes per hectare of dry stalks for fuel. Similarly, the productivity of Chickpea (Bengal gram), the dominant pulse crop, can also be increased by improved deep black soil management technology. Both Arhar and gram taken together account for 60 per cent of total production of pulses and if efforts are concentrated in improving their productivity, in the coming years, there is considerable scope for making a break-through in the productivity of pulses.

(iii) **Another thrust area is to boost the production of edible oils**—India is not self-reliant in the production of edible oils. The major oil seeds grown in India are groundnut, rape-seed, mustard, sesamum, safflower, sunflower, and soyabean. The principal problem in oilseeds production is low productivity. Not only India is way behind the developed countries, its productivity per hectare does not compare favourably even with respect to that of China and other developing countries. Imports of edible oils were barely of the order of ₹ 23 crores in 1970-71 but with increasing domestic demand and our failure to meet it with domestic production, imports of edible oils had gone up from ₹ 700 crores to ₹ 1,000 crores a year during the 1980's and exceeded ₹ 11,680 crores in 2003-04 but declined thereafter.

The Government of India set up the Technology Mission on Oilseeds which has proposed the target of raising production of oilseeds to 16 to 18 million tonnes by 1989-90 and raising it further to 26 million tonnes by the year 2000-01.

These targets were to be achieved by (a) bringing additional oilseed areas under irrigation, (b) modern crop technology, (c) crop substitutions, (d) better dry farming and (e) promoting oil palm cultivation in 6,00,000 hectares.

The short term target for oilseed production (i.e. 16 to 18 million tonnes by 1989-90) was fulfilled. The long range target (of 26 million tonnes by 2000 A.D.) was, however, achieved in 2004-05. Between these two years, production of oilseeds ranged between 21 mil-

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lion tonnes and 16 million tonnes. The Government to resort to production of Safflower and is the most promising.

(iv) **New Strategy Management**—The total gross area of 163 to 172 million tonnes in 2004-05 target of 234 million tonnes of foodgrains production (quintals) per hectare. As against 10 tonnes or 40 quintals of foodgrains per hectare, it is to meet the needs of 1,000 million people it is adoption of new strategy.

The total available area of 100 million hectares will take 12 to 15 years. Since water is vitally necessary for more efficient use. As more of water available is available according to experts, we therefore, be useful which economise water and reduce water use for irrigation available water in the future to meet the rising demand for water needs. The new strategy is directed towards the following:

- (i) control and protection of tanks and tank command areas;
- (ii) repair and maintenance of water harvesting structures;
- (iii) conjunctive use of surface and groundwater;
- (iv) using sprinkler and micro-irrigation areas;
- (v) introducing drip irrigation in dry areas;
- (vi) Biwall irrigation for sugarcane, vegetables, etc.
- (vii) training farmers in irrigation management.

In major irrigation areas, frequently over-irrigation leads to production. For instance, 100 mm of water for paddy is required while only 800 mm. Moreover, to take water to various fields makes the land saline.

Use of sprinkler irrigation saves 35 per cent of saving in all closely spaced pulses and wheat.

Drip irrigation can result in a water

pulses, which went to 36 to 37 million tonnes and consumption of more so for the source of protein. Under unirrigated water inputs. Out of pulses, only pulses do not require pesticides. The land improved types of raising over the last 10 years of pigeon-pea farmers and it is a source of pulse stalks for fuel. Bengal gram), increased by technology. At present for 60 per cent efforts are productivity, in the case for making pulses.

most the production is reliant in the seeds grown in India, sesamum, is the principal productivity. In developed countries, are favourably suited and other cereals were barely with increasing meet it with had gone up during the 2003-04 but

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lion tonnes and 16 million tonnes, forcing the Indian Government to resort to large import of oilseeds. Production of Safflower and Soyabean, however, has been the most promising.

(iv) New Strategies of Irrigation and Water Management

Management—The total foodgrains production from a gross area of 163 to 165 million hectares was around 212 million tonnes in 2001-02 (as against the Ninth Plan target of 234 million tonnes for that year). Our average foodgrains production is about 1.3 tonne (or 13 quintals) per hectare. As against this, China produces 4 tonnes or 40 quintals of foodgrains per hectare. If India is to meet the needs of its growing population of over 1,000 million people it must produce 240 to 250 million tonnes of foodgrains per year. This will necessitate the adoption of new strategies of irrigation.

The total available water reserves is of the order of 100 million hectare metres (mhm) during the next 12 to 15 years. Since water is a scarce resource, it is vitally necessary that emphasis be shifted on its more efficient use. As things stand today, 90 per cent of water available is allocated to irrigation. This is, according to experts, wasteful use of water. It would, therefore, be useful to develop irrigation strategies which economise water use. The target should be to reduce water use for irrigation to 77 per cent of total available water in the next 10 to 12 years, so as to meet the rising demand for water for industrial and municipal needs. The new strategy of irrigation should be directed towards the following:

- (i) control and proper method of irrigation in canal and tank command areas, specifically for paddy;
- (ii) repair and maintain the traditional system of water harvesting and recharge of surface water;
- (iii) conjunctive use of surface and ground water;
- (iv) using sprinkler irrigation in canal/tank command areas;
- (v) introducing drip irrigation in well irrigated areas;
- (vi) Biwall irrigation for closely spaced crops like sugarcane, vegetables and cotton; and
- (vii) training farmers and extension officers in water management.

In major irrigation projects, there is frequently over-irrigation, with its adverse effects on production. For instance, farmers use 1,500—3,000 mm of water for paddy, as against the requirement of only 800 mm. Moreover, absence of proper channels to take water to various fields leads to water logging and makes the land saline or alkaline.

Use of sprinkler irrigation can bring about 30-35 per cent of saving in water use. This should be used in all closely spaced crops like millets, groundnuts, pulses and wheat.

Drip irrigation is suitable for all row crops and can result in a water saving of 50-70 per cent, simul-

taneously raising yield by 60-70 per cent in various crops. It helps in economic use of water and is specially suitable for irrigation by wells.

Biwall irrigation is being recently experimented in Maharashtra. In this system, water is delivered from the main chamber with a distribution chamber through evenly spaced supply orifices provided by laser beams. It is then slowly released through the emission orifice.

The education of the farmers and the extension workers is vital in this thrust area of water management. For this, demonstrations, group discussions, seminars of farmers and other mass media be pressed into service. This is a thrust area which promises much better results with marginal addition of costs.

During the first eight Five Year Plans, much greater emphasis was laid on major and medium irrigation works. It is now being increasingly realised that this obsession with major irrigation works or big projects has raised the irrigation costs per hectare to prohibitive levels (₹ 60,000 per hectare on an average). Because of its cheapness and quick benefits the new thrust should be in favour of minor irrigation works.

(v) The use of bio-fertilizers has to be expanded

Recent researches in bio-technology and genetic engineering have demonstrated that certain micro-organisms such as bacteria and blue green algae can act as nitrogen fixers and provide nutrient to crop plants. The most commonly used bio-fertilizer is *Rhizobium* which colonizes the roots of specific legumes to form root nodules. These nodules act as factors of ammonia production. The *Rhizobium* legume association can fix 100-300 kg of nitrogen per hectare in one crop season and even leave substantial quantities of nitrogen for the next crop. The great breakthrough in nitrogen generation by micro-organisms, for which the bill is paid by nature, is a great advance in agricultural research that promises a second green revolution.

With new bio-technology, for algae, the cost of inoculant at the rate of 10 kg./ha. is around ₹ 20 and its nitrogen contribution in terms of fertilizer is ₹ 200-400 per hectare. If agricultural production is encouraged on these lines, it has the potential to generate income to the farmers of the order of ₹ 5,000—7,500 from one hectare of land through sale of the produce. The new bio-technology is, therefore, the answer to the problems of the small farmers in cutting down their costs of fertilizer use.

Whereas bio-technology in fertilizers has been successfully exploited in developed countries, several factors have hampered its use and propagation in India. They are : lack of trained personnel, lack of appreciation of the benefits of inoculation and absence of industrial support. The Ministry of Agriculture of the Government of India is sponsoring national projects on these subjects. This should give a major thrust in agricultural development in future.

(vi) Emphasis should shift to dry farming— Out of total cultivated area of 163 million hectares in India, dry farming is carried on in 100 million hectares i.e. in 60 per cent of the total arable land. But the contribution of dry land farming to agricultural production is less than 30 per cent.

There is no doubt that irrigation has brought about national self-sufficiency in foodgrains, but the gap between the rich and the poor farmers has widened because of the use of irrigation. About two-thirds of dryland farmers own less than two hectares and even this is available in scattered and fragmented holdings. Since the country has to carry on with dryland farming for many years to come, it is vitally necessary that dry-farming technology be developed, so that the possibilities of raising the potential output of vast dry-land areas be exploited. For this purpose, problems of different dryland areas have to be studied and region-specific technology have to be developed. Moderate use of fertilizers, improved seeds and better conservation of rain water and its judicious use can contribute to 40 to 50 per cent increase in yields in rain-fed areas.

To conclude : The annual rate of growth in foodgrains output during nineties was just about 1.7 per cent, which is much lower than 3.5 per cent annual growth recorded in the eighties. The yield rates have more or less plateaued in major wheat and rice growing areas. Hence the government should give special attention to those areas where productivity is much below the national average. Eastern Uttar Pradesh, Bihar, Madhya Pradesh and Orissa should be the target areas where higher investment in rural infrastructure by way of improved water conservation and delivery system, fertiliser use and credit availability could be concentrated.



6. GREEN REVOLUTION – THE FUTURE PROSPECTS

Green Revolution initiated in the 1960's centered around the use of semi-dwarf high yielding varieties responsive to irrigation and chemical fertilizers yielded good results in giving a big boost to the production of wheat in the first stage and the production of rice in the next stage. But more recently, it has been felt that high-yielding varieties have reached a plateau and the scope for future increase in production appears to be very limited. In other words, the seed-water-fertilizer technology has probably exhausted its potential and is now at a point of diminishing returns.

The Planning Commission set a target of foodgrains production of the order of 300 million tonnes by 2007-08 but the actual production was 216 million tonnes. The question raised is: What are the prospects of realising this target?

Some like Harish Damodaran do not subscribe to the view that agricultural production has reached a plateau.

TABLE 18 : Average Foodgrain Yield

Kgs per hectare

	1960s	1970s	1980s	1990s	2010-11
Foodgrains	719	894	1,156	1,490	1,921
Wheat	950	1,382	1,921	2,449	2,938
Rice	1,000	1,158	1,470	1,827	2,240

*Advanced estimates for 2008-09.

Source: Harish Damodaran, Green Revolution Fatigue, Business Line, May 27 & 28, 1999.

Economic Survey : 2011-12, Agricultural Statistics At a Glance 2011.

Data given in Table 18 indicates that foodgrain yield has continued to increase from 719 Kgs. in 1960s to 1,490 Kgs. during 1990's and to 1,921 in 2010-11. The increase in yield has been more pronounced in the case of wheat from 950 Kgs. in 1960s to about 2,450 Kgs. in 1990s and 2,938 in 2010-11, although in rice too yield has gone up from 1,000 Kgs. in 1960s to 2,240 Kgs. in 2010-11. While bringing more areas under High Yielding Varieties, highest yield rates may have shown some signs of stagnation.

It would, therefore, be necessary to understand the theoretically obtainable maximum yield and the actual realisable maximum. It may be noted that the first Green Revolution variety Sharbati Sonora had demonstrated a yield potential of about 3.4 tonnes per hectare. The next jump in yield variety came from Kalyansona in 1970 to 4.2 tonnes. For a major breakthrough, the country had to wait till 1994 when new rust-resistant varieties like UP2338 jacked up yields to 5.1 tonnes and PBW 343 in 1995 to boost it further to 5.4 tonnes per hectare.

However, in rice, the picture has not been very encouraging. Consequently, the skeptics believe that traditional Green Revolution breeding techniques have come to a dead end. Whatever success has been achieved in rice is the consequence of extending the pioneering varieties to more and more areas so that the country can realise the potential.

But this does not signify that we have exhausted all the latent potential of the existing HYV varieties. Field trials in Punjab confirm the demonstrated potential of 5.5 tonnes per hectare, but actual mean yields are around 4.25 tonnes per hectare. Obviously, one tonne of unharvested yield potential exists in Punjab. Similarly, the situation in other wheat growing states indicates the gap between attainable and actual yields to rise to over two tonnes per hectare. Mr. Harish Damodaran, therefore, concludes: "Even with the current high yielding varieties, it is possible for farmers in the Indo-Gangetic plain, which accounts for 18 million hectares out of 26 million hectares under wheat to produce an additional 25 million tonnes of wheat by adopting improved crop management practices and ensuring timely supply of inputs, attractive

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Future Prospects

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Foodgrain Yield Kgs per hectare		
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1,921	2,449	2,938
1,470	1,827	2,240

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prices and so on. A half-a-tonne increase in average per hectare rice yield can similarly generate an additional 20 million tonnes from the country's 42 million-odd hectares area planted under paddy.”⁷

A point often made by critics that as against average yield of 4 to 4.5 tonnes of wheat in Punjab, the farmers in cold countries like Netherlands raise about 8 tonnes per hectare, but this comparison ignores one important difference in the cropping systems of the two countries.

The eminent agricultural scientist Dr. M. S. Swaminathan emphasises that it is unscientific to make comparisons purely on the basis of individual crops, but it would be more scientific to compare the cropping system as a whole. For instance, a farmer in Punjab may obtain only 4 to 4.5 tonnes per hectare yield on spring wheat of 140 days duration, but his counterpart in Netherlands obtains 8 tonnes per hectare on a 10-month winter wheat crop. The difference is made up by the Punjab farmer by raising a rice crop during the same year providing a yield of 3 to 3.5 tonnes per hectare. He may also be raising a crop of potato or legume or some short-duration vegetable. Obviously, for the Indian farmer, the more important consideration is the total yield during the year, rather than simply yield per crop. Thus, the transformation from a mono cropping to multi-cropping system has enabled the development of rice or wheat varieties of different maturities, which have been integrated in the phenomenon described as the Green Revolution. Obviously, the success of the Green Revolution should be judged in terms of the over-all yield (income) generated by the farmers per hectare in a year rather than in terms of productivity per hectare of a single crop.

Future Prospects

Scientists in India have been making efforts to develop hybrid varieties of rice and wheat so that the yield barrier operating at present can be broken. In the case of rice, on-farm-trials of hybrid rice in Andhra Pradesh Tamil Nadu and Karnataka have been found to yield an average of 6.8 tonnes per hectare as against 5.2 tonnes obtained from conventional pure-line rice varieties. This amounts to an additional yield of 31 per cent viz., 1.6 tonnes per hectare. In some cases, hybrid rice yield is even higher by 35 to 44 per cent than the conventional varieties. In other words, gains from hybrid rice have been estimated to be 1.5 to 1.75 tonnes per hectare. Despite success at on-farm trials, India has been able to bring only 0.15 million hectares under hybrid rice as against the target of 2 million hectares by the year 2000. The following factors are responsible for the slow progress:

- (a) Since the additional seed costs for hybrid seeds are of the order of ₹ 1,500 per hectare, the yield gain has
- 7. Harish Damodaran, Green Revolution Fatigue – Have yields begun to plateau, *Business Line*, May 27, 1999.

not been enough to translate into substantially higher returns to the farmer. As a consequence, the farmers have not felt enthused about the use of hybrid rice.

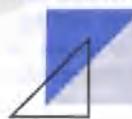
(b) The presence of an aroma and stickiness in the hybrid-rice grain has not been able to make it acceptable to the consumers, particularly in South India. Consequently, hybrid rice fetches lower prices, which again produces an unfavourable impact on the rate of return to farmers.

(c) Hybrid rice is also said to be more susceptible to pests and diseases.

According to Mr. Harish Damodaran, China is “the only country that has so far really managed to adopt hybrid technology in any significant way. More than 50 per cent of China's 32 million hectares rice area is currently covered under hybrid rice, which also accounts for 70 per cent of total rice output. To make hybrid rice more acceptable to the farmers, China provided seeds to farmers at subsidised prices. Besides, the Chinese government provided incentives to hybrid seed growers to bring down costs. China has also standardised its hybrid seed production techniques, with seed yields averaging 2.5 tonnes per hectare, against 1 to 1.5 tonnes being obtained by experienced breeders in India.

India should make an effort to bring down the seed costs by standardizing hybrid rice seed production techniques. The Government should also provide hybrid rice at subsidised rates to farmers.

However, the hybrid technology in wheat is still at an infant stage of development and research efforts shall have to be strengthened for quite some time so as to achieve a break-through in the yield barrier.



7. THE NATIONAL COMMISSION ON FARMERS AND SECOND GREEN REVOLUTION

The UPA Government, after coming to power in 2004, appointed the National Commission on Farmers under the chairmanship of Dr. M. S. Swaminathan, eminent agricultural scientist. The Commission has made recommendations which promise to rejuvenate agriculture and thereby improve the lot of millions of farmers.

For the purpose of suggesting policy measures, the term “Farmer” includes landless agricultural labourers, sharecroppers, tenants, small, marginal and sub-marginal cultivators, farmers with larger holdings, fishermen and women, dairy, sheep, poultry and other farmers involved in animal husbandry, pastoralists, as well as those rural and tribal families engaged in a wide variety of farming related occupations such as sericulture, vermiculture, production of bio-fertilizers and bio-pesticides, and agro-processing.”

“The term also includes tribal families sometimes engaged in shifting cultivation, and in the collection and

use of non-timber forest products. In all cases, both men and women should receive equal attention."

Statement of the Problem of Farmers

Farmers have to face the fury of nature in the form of drought, unseasonal and heavy rain which causes extensive damage to crops.

Institutional support to small farmers is weak. Even now in many parts of India, paddy is spread on the roads for drying. The loss due to lack of proper storage and maintenance due to spoilage is as heavy as 30 per cent in the case of fruits and vegetables.

The cost of production is invariably higher than the minimum support price, due to ever-increasing price of diesel and other inputs.

Capital formation in agriculture and allied sectors as percentage of Gross Domestic Product (GDP) started declining in the 80's and is only now being reversed. This has adversely affected irrigation and rural infrastructure. As a consequence, small farm families commit suicides and the number of suicides has been growing in India during the last five years. The situation is particularly alarming in Vidarbha region of Maharashtra. The government has identified 31 districts where farmer suicides have been reported. These are spread over Maharashtra, Andhra Pradesh, Karnataka and Kerala. The Prime Minister felt so much disturbed that he undertook a visit of Vidarbha and declared a package of Rs 4,000 crores to improve the lot of farmers and to alleviate their pathetic condition decided to waive off heavy loans undertaken by them. The Government agreed to provide a subsidy to banks and co-operative credit institutions to enable them to accommodate the impact of loan waiver by making a provision in the budget. The loan waiver cannot be restricted to one state only, but will have to be provided to all states affected by farmers' distress.

Since the cost-risk structure of farming is becoming adverse, indebtedness is growing among farmers. According to NSS Survey – 59th round, 55 percent of the farm households are in debt in 2003. The average per capita monthly consumption expenditure of farm households across India was ₹ 503 in 2003.

Endemic hunger (i.e. chronic malnutrition) is high both in families without assets like land or livestock, as well as those with small land holdings without access to irrigation.

Only 10 per cent of farmers are covered by crop insurance. Farm families are also not covered by health insurance.

Women, by and large, have been denied the benefit of Kisan Credit Card System.

Strategy to improve the economic condition of farmers

Outlining the basic philosophy of the National Commission on Farmers, the recommendations emphasis-

size the need to increase farm productivity and profitability in perpetuity without ecological harm. If the country adopts this strategy, the present agricultural crisis can then be converted in an opportunity for not only reversing the decline, but for taking our agricultural evolution forward. For this purpose, it would be essential to bridge the gap between potential and actual yields in agriculture. This will require the intensive introduction of mutually reinforcing packages of technology, services and public policies.

This **Agricultural Renewal Action Plan** has five components which include the following:

(1) **Soil health enhancement:** Agricultural Universities, research institutes, Krishi Vigyan Kendras, fertilizer companies, states department of agriculture and farmers' associations should aim at increasing the productivity potential of the soils by paying adequate attention to the chemistry and physics of soils (macro and micro-nutrients) and microbiology. Dry farming areas should receive special attention.

(2) **Irrigation Water Supply Augmentation and Demand Management:** National Commission on Farmers made a very forthright declaration: Water is a public good and a social resource and not private property. The privatization of its distribution is fraught with dangers and could lead to water wars in local communities. Improving supply through rainwater harvesting and recharge of aquifers should become mandatory.

10 million hectares of new area under irrigation should be developed under Bharat Nirman.

All existing wells and ponds should be renovated.

Seawater farming should be promoted in coastal areas through the cultivation of mangroves, salicornia, casuarinar and appropriate halophytic plants.

Demand management through improved irrigation practices, including sprinkler and drip irrigation should receive priority attention.

(3) **Credit and Insurance:** The National Commission on Farmers considers: "Credit reform is the primary pathway to enhancing small farm productivity and ending farmer suicides."

Firstly, the difference between lending and deposit interest rate is high in India by international standards. This needs to be reduced. Keeping in view, the decline in profitability and the farmers' distress, it would be desirable for the government to reduce the rate of interest on crop loans to 4 per cent.

On account of droughts and floods and the high interest on farm loans, the farmers become defaulters and thus the credit system pushes them out of its network. To meet natural calamities, the Central and State governments must step in to create an Agriculture Risk Fund to provide relief. This may be in the form of full/part waiver of the loan and interest.

(4) **Technology:** Agriculture scientists should state the performance of new varieties and technologies in terms of *net income per hectare*, and not just in terms of yield per hectare.

Moreover, there is a need for proper integration of production and post-harvest technologies. For this purpose, the Commission suggests that a post-harvest technology wing should be added to Krishi Vigyan Kendras. Also, lab-to-land demonstrations should be organized in dry farming areas where millets, pulses, oilseeds and cotton are grown. Value addition to biomass will help to generate skilled jobs in the non-farm sector.

Rice covers the largest area in the country and there are opportunities for creating more jobs and income by establishing rice bio-parks. Similarly, eco-boards can be produced from cotton stalks as a replacement for plywood from timber.

A cadre of Rural Farm Science Managers should be developed by training some members in every panchayat to manage these new technologies. It would be necessary to establish a professional National Biotechnology Regulatory Authority without further delay.

(5) **Market:** Ultimately, it is only opportunities for assured and remunerative marketing that will determine the economic viability of farming both as a way of life and as a means to livelihood. Market reform should begin with production planning, so that every link in the cultivation-consumption-commerce chain receives adequate and timely attention.

A Land Use Advisory Service is needed so that informed decisions are taken with ecological, meteorological and marketing factors being kept in view.

The National Commission on Farmers Concludes: "We should not remain silent spectators to agricultural decay. Both food and human security and national sovereignty are at stake. Overall economic growth rates have little meaning if we do not look after the economic health and survival of over 60 percent of our population." The NCF in its 4th Report has warned that ignoring agriculture despite Jawaharlal Nehru's "Agriculture cannot wait" declaration will have three consequences:

(a) Spread of agrarian distress and rural discontent and the spread of the Naxalite Movement.

(b) Returning to "Ship to mouth" era, and the consequent erosion of national sovereignty in foreign policy.

(c) Jobless or even job-loss growth resulting in the expansion of urban slums.

The NCF exhorts the nation to end this sad chapter in our agricultural history and fulfil the "Jai Kisan" commitment made by Lal Bahadur Shastri. The steps to be undertaken are simple, doable, and affordable. They, however, need a change in the mindset from regarding farmers as "beneficiaries" of small government programmes to treating them as partners in development and custodians of food security.

Five Point Action Plan

The NCF has suggested a five point action plan for the revival of agriculture:

First, undertake soil health enhancement through integrated measures in improving organic matter and macro-and-micro-nutrient content, as well as the physics and microbiology of the soil.

Secondly, promote water harvesting, conservation, and efficient and equitable use by empowering gram sabhas to function as "Pani Panchayats".

A sustainable water harvesting system should be established, particularly in rainfed areas lacking assured irrigation. This can be facilitated by mandatory water harvesting and greater attention to dry land farming.

Thirdly, immediately initiate credit reforms coupled with credit and insurance literacy. The Finance Minister has announced a reduction in the interest on short-term loans to 7 percent. This should be regarded as the first step towards further reduction in interest rate as recommended by the NCF and the revitalization of the cooperative credit system. In chronically drought-prone areas, the repayment cycle should be extended to four to five years. Besides this, the credit delivery system should be made gender sensitive.

Fourthly, bridge the growing gap between scientific know-how and the field level do-how both in production and post-harvest phase of farming. This could be accomplished by organizing the training of agricultural workers as farm science managers, strengthening Krishi Vigyan Kendras (Agricultural Science Centres) in both production and post-harvest technologies and organizing nation-wide lab to land demonstrations in the areas of agricultural diversification, food processing, and value addition.

In nutshell, low economic risk, high factor productivity and avoidance of ecological harm should form the fundamentals of all agricultural research and development strategies. Success in agricultural progress should be measured by growth rate in farmers' income and not just by production figures.

Finally, the gap between what the rural producer gets and the urban consumer pays should be made as narrow as possible, as has been done in the case of milk by Dr. V. Kurien.

At the same time, there should be a Risk Stabilization Fund and a farmer centric Minimum Support Price (MSP) and Market Intervention Scheme (MIS).

The Commission emphasizing the importance of agriculture and farmers in our economy states: "Agriculture in our country is based on the technology of production by the masses. As a consequence, it is the backbone of the national livelihood security system."

"The Indian tragedy of extensive poverty and deprivation persisting under conditions of impressive progress in the industrial and services sectors will continue so long as we refuse to place faces before figures."

National Commission on Farmers and Second Green Revolution

Dr. M.S. Swaminathan, the architect of India's first green revolution listed five components of Agricultural Renewal in his report as Chairman of the National Commission on Farmers. These five components suggested by the Commission are: Soil health enhancement; water harvesting and sustainable and equitable use of water; access to affordable credit and crop and life insurance reform; development and dissemination of appropriate technologies and improved opportunities; infrastructure and regulation for marketing of agricultural produce.

Inaugurating the 93rd Indian Science Congress on June 3, 2006, Prime Minister Manmohan Singh added two more components: (a) application of science and biotechnology to the improvement of seeds and utilization of herbal and other plants; and (b) application of science to animal husbandry to improve productivity of livestock and poultry. It may, however, be mentioned that these two components were already covered by the National Commission on Farmers. For instance, Dr. Swaminathan mentions: "Had we adopted a pro-small farmer biotechnology strategy, we would by now have had Bt-cotton varieties whose seeds farmers could keep and replant, unlike in the case of the hybrids marketed by private companies." NCF has, therefore, made a categorical case for vesting in the Indian farmers the right to use their own seeds developed by them, rather than remain dependent on private companies and multinationals to get them patented and then deny this right of use to Indian farmers.

Although, Prime Minister Manmohan Singh has given a call for a "Second Green Revolution," it would be of interest to understand why the first green revolution has run out of steam. Two reasons were ascribed by the Prime Minister: First, it did not benefit dryland farming. Second, it was not scale-neutral and had thus benefited only large farms and big farmers. This implies that 62 percent of marginal holdings accounting for 17 percent of operated area and 31 percent of small holdings of size 1 to 4 hectares accounting for 55 percent of area operated were bypassed by the first green revolution. Although, production of foodgrains and other crops substantially improved in India but the spread of green revolution in reducing poverty remained rather limited. It is due to this reason that it is now being argued and rightly so by the Prime Minister that the Second Green Revolution should concentrate on the small and marginal farmers.

A confirmation of the failure of first green revolution to ameliorate the condition of the small and marginal farmer is provided by National Sample Survey data on rural indebtedness. Post-liberalization Rural India sarcastically referred to as Bharat, became more indebted, according to the latest NSSO data for the period January to December 2003. In just one year, rural household indebtedness increased from 4 percent to 27 percent. This

more than six-fold increase in rural indebtedness is a pointer to the deteriorating condition of rural households. At the national level, rural household indebtedness accounts for ₹ 1,12,000 crores which is more than 63 per cent of India's total outstanding debt of ₹ 1,77,000 crores.

Average per capita monthly expenditure of farm household in India as a whole was Rs 503 which is just Rs 135 above the rural poverty line for rural India for 2003 at Rs 368. This average includes large and very large size farm households. But the states which have an average MPCE even below the poverty line or just above the rural poverty line are – Orissa (Rs 342), Jharkhand (₹ 353), Chattisgarh (₹ 379) and Bihar (₹ 404). In the 31 districts identified by the Government in the states of Maharashtra, Andhra Pradesh, Karnataka and Kerala where farmers suicides are taking place, the monthly per capita expenditure of rural households is below the rural poverty line expenditure. The lack of irrigation facilities and availability of other inputs are responsible for denial of income security needed for a reasonably good life. The failure of our agricultural scientists to develop superior crop varieties, which would have provided higher yields would have pushed our foodgrains production much higher than the current level of 210 million tonnes. It may be noted that China has been able to raise its foodgrains production to 550 million tonnes, more than two and a half times as compared with India, though the Chinese population is only 300 million more than the Indian population.

The Eleventh Five Year Plan Approach Paper emphasizes the need for promoting 'inclusive growth'. If the dream of the approach paper has to be translated into reality, then as indicated by the National Commission on Farmers, the Second Green Revolution should specifically address the problems of marginal and small farmers so as to provide them income security. This can happen only if small and marginal farmers are treated as partners in development in the Second Green Revolution, rather than as mere beneficiaries of some government programmes. For this purpose, the process of implementation of the policies enunciated by NCF should lay special focus on improving the lot of small and marginal farmers.

The Report of the National Commission on Farmers is a technological document. The Report has laid special emphasis on improving technology and irrigation facilities, but it is silent on land reforms. This is also true that there is no movement about land reforms in India, but still it is possible to introduce co-operative joint farming. Recently, the Adat Farmers Co-operative Bank made a very successful effort in co-operative joint farming. In this experiment, 2,400 farmers in Thrissur district in Kerala pooled their land for joint cultivation. This was a realization by the small farmers of the hard reality that the small size of their holdings was responsible for low productivity, high cost of cultivation and the low level of income of the farmers. In co-operative joint farming, the farmers contribute their land and for this, they are paid an ownership dividend in the proportion of land contributed

by them. Besides, receive wages on hired by them. The crore on the sale of was ₹ 2.10 crore crores which was a share dividend ₹ each farmer. Many other states as well helped the success leadership which among co-operative marginal farmers agricultural holding the strategy of can sincerely, can make the economic com



Crop Pattern

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TABLE 19.

Crops
(a) All Crops
(b) Foodgrains
(c) Non-foodgrains

Source: Agricu

Table 19 shows the area under cultivation of all crops in the country from 1960-61 to 1995-96. There is a definite shift in the cropping pattern from 1970-71, the ratio of foodgrains to non-foodgrains was 74 : 26 and by 1995-96, it further declined to 54 : 46. The reasons may be the increase in foodgrains.

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by them. Besides, those who contribute their labour also receive wages on the basis of the hours of work contributed by them. The Co-operative Bank received Rs 5.10 crore on the sale of paddy produce. The cost of cultivation was ₹ 2.10 crores. Thus, there emerged a profit of ₹ 3 crores which was distributed among the farmers as ownership dividend on the basis of the land contributed by each farmer. Many such efforts have also succeeded in other states as well, the most important factor which helped the success of these experiments was an honest leadership which operated the scheme. Thus, by encouraging co-operative joint farming, the lot of the small and marginal farmers can be improved. Since 93 percent of agricultural holdings belong to small and marginal farmers, the strategy of co-operative joint farming, if followed sincerely, can make an effective contribution to improve the economic condition of the small and marginal farmers.



8. CROP PATTERN IN INDIA SINCE 1951

Crop Pattern Before Independence

By cropping pattern is meant the proportion of area under different crops at a point of time. A change in cropping pattern implies a change in the proportion of area under different crops. At the beginning of the century, more than 83 per cent of land was put under food crops and about 17 per cent under non-food crops. By 1950-51, area under food crops had come down to 74 per cent and area under non-food crops had increased to 26 per cent.⁴ This shift in crops from foodgrains to non-foodgrains was mainly due to the higher price of non-foodgrains, commonly known as cash crops. It reflected a change from subsistence cropping to commercial cropping.

TABLE 19. Nature of Crop Distribution of Area Since 1951

Crops	1950-51	1970-71	2006-07	2010-11
(a) All Crops	100	100	100	100
(b) Foodgrains	75	74	64	66
(c) Non-foodgrains	26	26	36	34

Source: Agricultural Statistics at a Glance 2010-11.

Table 19 shows the share of different categories of crops in the total area sown. The acreage figures from 1960-61 show a reversal of the above trend, and a definite shift from non-foodgrains to foodgrains. By 1970-71, the ratio of foodgrains to non-foodgrains was 74 : 26 and by 2010-11, the share of foodgrains has further declined and stand at 66:34. Two important reasons may be given to explain this shift in favour of foodgrains.

(a) Prices of foodgrains have been rising quite fast and the farmers have started growing foodgrains for the market, in the same way they grow oilseeds,

cotton and other commercial crops. In other words, the traditional classification between food crops and commercial crops is losing its significance.

(b) The cultivation of foodgrains has become highly remunerative and productive under the impact of the new technology.

Among foodgrains, the largest increase in area has been recorded by wheat, with an increase of 150 per cent. While the increase in the case of rice has been quite modest (36%), coarse cereals have recorded only marginal increase, indicating a positive shift from minor to major crops. Increase in acreage under pulses has been modest.

The traditional commercial crops, viz., oilseeds, cotton, jute, sugarcane, etc., have made impressive increases in acreage, much more than food crops (with the exception of wheat). Of these, the most spectacular was the increase in acreage under potato, viz., by over 300 per cent between 1951 and 2005. By 2004-05, the ratio of foodgrains to non-foodgrains was 64 : 36.

Factors Affecting Cropping Pattern in India

At one time many believed that cropping pattern in India could not be changed. S.N. Sinha, for instance, gave expression to such an opinion when he wrote : "In a tradition-ridden country with a very low level of knowledge, the peasants are unwilling to make experiments. They accept everything with a spirit of resignation and a sense of fatalism. For them, agriculture is a way of life rather than a commercial proposition. ...In an agricultural community where the members are illiterate and tradition-ridden, there is hardly any possibility of crop shifts."⁸ This opinion is not correct any more as is clear from the change in cropping pattern in Punjab. It is widely agreed that the crop pattern of a country like India can be changed and should be changed.

1. Physical and Technical Factors and Cropping Pattern

Cropping pattern of any region depends upon physical characteristics as soil, climate, weather, rainfall, etc. For instance, in a dry area where the rainfall is scanty and where there is high uncertainty of monsoons, there will be a greater dependence on jowar and bajra, as these crops can be managed with a small quantity of rainfall. Water-logging in parts of Ludhiana and Sangrur districts in Punjab has led to an increase in area under rice; for rice can stand the extra water better than other crops. In the newly reclaimed lands of Madhya Pradesh, millets are grown for a few years after which rice is cultivated.

8. S.N. Sinha : "Economics of Cropping Pattern" in *AICC Economic Review*, Vol. XV, January, 1964.

Apart from soil and climatic conditions, the cropping pattern of a region will depend upon the nature and availability of irrigation facilities. Wherever water is available, not only can a different crop be grown, but even double or triple cropping will be possible. When new irrigation facilities are provided, the whole method of cultivation may change. A superior crop can be grown; a new rotation of crops where there was none, or a better rotation over what prevailed may be possible. One of the important factors responsible for increase in the cultivation of sugarcane, tobacco, etc., is the extension of irrigation facilities. It is possible that because of lack of capital, agricultural pre-requisites, better implements, improved seeds and finance for getting fertilisers, it might not have been the right crop that was being grown; but given these facilities, the cropping pattern may change.

2. Economic Factors and Cropping Pattern

Economic motivations are the most important in determining the cropping pattern in a country. Whatever may have been the position in India in the past there are very clear indications that Indian farmers are being clearly influenced by economic factors now. Among economic factors affecting crop pattern, the following are important :

(i) **Price and income maximisation.** According to a study of inter-crop price parities undertaken by the Ministry of Food and Agriculture, "It seems that prices influence the acreage under the crops in two ways. One is that the variations in the inter-crop price parities led to shifts in acreage as between the crops. Another is that the maintenance of a stable level of prices for a crop . . . provides a better incentive to the producer to increase the output"¹⁹ Fixed procurement price of wheat and rice and other Government controls have induced farmers to shift to cash crops like sugarcane.

According to some authorities, income maximisation pull has greater influence in changing the crop pattern, that is, the farmer would choose that combination of crops which would give him maximum of income. Dr. Raj Krishna, however, argues that relative profitability per acre is the main consideration which influences the crop pattern.

(ii) **Farm Size.** There is a relationship between farm size and the cropping pattern. The small farmers are first interested in producing foodgrains for their requirements. They would go in for cash crops only after they have met their requirements of foodgrains. Small holders, therefore, devote relatively small acreage

9. Indian Journal of Agricultural Economics, Vol. XVIII, No. 1. Conference Number, "Agricultural Price Policy in India" (Memo), Directorate of Economics and Statistics, Ministry of Food and Agriculture. S.N. Sinha : *"Economics of Cropping Pattern" in AICC Economic Review*, Vol. XV, January, 1964.

to cash crops than large holders. This point has been brought out in many empirical studies. But a study of Deoria district of Uttar Pradesh brings out clearly the fact that almost all farmers, big and small, try to grow some cash crops. In fact, in recent years it is the small farmers who have been increasing their sugarcane area more than large farmers.

It is true that the need for subsistence has traditionally dominated the cropping pattern of the small farmer. But his need for money income cannot be less than that of the large farmer. And, as the economy grows, we should expect the small farmer to make very significant adjustments in his crop pattern in order to maximise his income.

(iii) **Insurance against risk.** The need to minimise the risk of crop failures not only explains diversification but also some specific features of crop patterns. For instance, the persistence of millets in many regions which puzzles many economists can be understood mainly as insurance against bad seasons in dry areas.

(iv) **Availability of Inputs.** As already indicated, crop pattern is also dependent upon the availability of such inputs as seeds, fertilisers, water storage and marketing, transport, etc. Of the additional facilities, the most rewarding would be irrigation. The availability of groundnut seed was one of the important factors which induced many farmers to increase the area under this crop in Madhya Pradesh. Another reason why farmers prefer groundnut to cotton is that the former is quick yielding, while cotton is on the field for a long time, and does not easily satisfy the need for quick cash.

(v) **Tenure.** Under the crop sharing system, the landlord has a dominant voice in the choice of the cropping pattern and this helps in the adoption of income-maximising crop adjustments.

3. Government Action and Crop Pattern

Government can influence crop pattern through legislative and administrative measures. Steps may be taken by the Government to ease or subsidise the supplies of the farm inputs and knowledge. The provision of irrigation facilities or the supply of seeds and fertilisers, etc., may be related to the adoption of a given crop pattern by the farmers.

Apart from the personal prejudices, and inadequate financial and other resources of the farmers, there may be factors like recurrent drought or pest infestation that prevent them from opting for a more remunerative set of crops. In those situations if more of irrigation, institutional credit fertilizers pesticides etc. are made available, it would be possible for them to change the crop-structure and so earn larger returns from their land. To the extent it is not possible for a farmer to acquire all these by himself, the Government could come to his help and procure these for him.

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Yet other possibilities of helping the farmer to improve the cropping pattern are building of new roads which will improve the flow of commodities to the market where they will fetch better prices and help to establish industries or townships nearer to their land.

Horticulture : New Initiative.

Indian farmers are now appreciating the importance of horticulture — the sector includes fruits, vegetables, spices, floriculture and coconut — in improving the productivity of land, generating employment, providing nutritional security and improving their economic conditions. Horticulture covered over 18.7 million hectares of land in 2005-06, accounting for 9.5 per cent of the gross cropped area of the country (12.3 million hectares in 1991-92). Between 1992 and 2006 production of major horticultural crops rose from 97 million tonnes to 182 million tonnes, India has tremendous scope to increase horticultural products — India is the second largest producer of fruits in the world (55 million

tonnes and 10 per cent of the global production) and highest producer of vegetables in the world (110 million tonnes). Indian farmers are going in a big way to adopt new crops and new pattern by production.

Conclusion

The most important consideration affecting cropping pattern is the economic consideration. Even in a country like India which is dominated by farmers steeped in poverty and conservatism and where farmers hold tiny bits of land, cropping pattern can be changed through appropriate change in economic motive. Experience in recent years has been that the farmer does accept the logic for a change wherever he is shown a better cropping pattern. The real difficulty in adopting a better cropping pattern is that the farmer may not have the requisite capital to invest now or possess the know-how that may be necessary for changing the crops. It is here that the Government may come to his help.

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